STRUCTURAL CHANGE AND GROWTH IN THE INDIAN ECONOMY : AN INPUT – OUTPUT APPROACH

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by

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to the

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February, 1993

CERTIFICATE

It is certified that the work contained in the thesis entitled "STRUCTURAL CHANGE AND GROWTH IN THE INDIAN ECONOMY : AN INPUT-OUTPUT APPROACH" by Ms. Sangeeta Dhawan has been carried out under my supervision and that this work has not been submitted elsewhere for a degree.

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This dissertation presents an analysis of structural change and growth in the Indian economy during the period 1968-69 to 1983-84. For rapid economic development of India a comprehensive strategy has to be evolved which needs efficient planning. The first requirement of such planning is to understand the structure of the economy as comprehensively as possible. This study is an effort in this direction. The selection of the period 1968-69 to 1983-84 for the purpose of this study was dictated by the availability of data.

The empirical data for this study was provided by the Indian Input-Output tables prepared for the years 1968-69, 1973-74, 1978-79 and 1983-84. In addition, this study also used supplementary data on employment collected from different sources. The analysis presented in this study can best be described as comparative, static analysis and was carried out within the context of the static, open I-O model. For purposes of this study, structural change was referred to as an analysis of changes in the production structure, in the employment structure, in costs (or prices) and an analysis of changes in the technology used in production processes. The study also analysed the

relationship between structural change and growth in the Indian economy.

Before these analyses were undertaken, however, a number of adjustments were made to the Input-Output tables to improve the comparability of these data. These adjustments involved the aggregation of selected industries to bring all the tables to a standardised 46-sector classification, and the deflation of the 1968-69, 1973-74 and 1978-79 tables to 1983-84 factor prices. Inspite of these adjustments to the Input-Output tables, a certain degree of incomparability remained and the results of this study must be interpreted accordingly.

The orientation of this study was to bring together and empirically test the methodology of analysis of structural change in the I-O framework by using the available Indian I-O tables. That is, the two strands viz. methodology and empirics run side by side throughout the study equally importantly. The output, employment and cost aspects of structural change were examined by studying the sectoral shares of the 46 sectors, by decomposing any increase in each of these aspects into different sources of growth and by studying the contribution of different final demand categories (like private consumption, government consumption, investment, exports and imports) to any increase in output or employment or costs. The sources of growth measured the contribution of factors like changes in I-O relations, changes in the level and composition of final demand and changes in the interaction factor(s) to any increase in these aspects. This study is an improvement over similar existing studies in the sense that it measures the interrelationship of the effect of

changes in final demand and changes in I-O relations on changes in output, employment and costs. This interrelationship has been called the interaction factor(s) in this study. Existing studies in the literature so far have ignored this aspect. Further, this study deals with the empirical investigation of changing cost structures of industries. This aspect too has been given less importance in the past studies.

Structural change in technology was studied by examining the change in the most important I-O coefficients. Finally, the relationship between structural change and growth in the Indian economy was examined with the help of simple regression analysis.

The results showed that the structure of Indian production diverted from agriculture to industry, specially to heavy industry and to services over the period 1968-69 to 1983-84 and of all components, change in the level of final demand was the most significant factor affecting the increase in output. The effects of changes in the composition of final demand and changes in I-O relations showed a decline in the demand of output of traditional industries like agriculture and industries connected to agriculture and an increase in the demand of the output of industries like chemicals, textiles, paper, machinery and electric power. The contribution of the change in composition of final demand component for the entire economy was positive but small indicating a shift in final demand in favour of more interdependent industries and away from the more independent industries like agriculture. The impact of changing I-O relations

on increase in output over the period under study too was small. This finding is evidence of the general stability of I-O coefficients of an economy which is derived from the stability of the underlying technological relationships as well as interdependencies among industries.

Regarding employment structure, the results of the study showed that the share of agriculture in total employment declined marginally while those of the secondary and tertiary sectors increased marginally over the period under study. The sources of employment growth showed that changes in the distribution of final demand and changes in coefficients resulted in a significant reduction of labour requirements implying the trend of mechanisation of most production processes in India and the conflict between the output and employment generation objectives of our Five Year plans.

The analysis of different final demand categories showed that output and employment growth in the Indian economy during 1968-69 to 1983-84 was largely due to the growth in consumption demand and investment demand.

The analysis of cost shares showed that 90 percent of the cost share change of most sectors was contributed by the change in factor price component, the remainder being contributed by changes in primary input coefficients, changes in intermediate input coefficients and changes in interaction factors.

Other broad results showed the change of the Indian economy from a more investment oriented economy to a more consumption oriented one and an increase in the role of foreign trade implying the opening up of the economy over the period

under study. Some other results showed that the proportion of intermediate demand in the total output increased while the number of zero coefficients decreased signifying the technological advancement of the economy.

The analysis of structure-growth relationship showed that economic growth in India is encouraged by the backward linkage structure but not by the forward linkage structure of the economy.

The findings of the study will help to understand the structure of the Indian economy in a more meaningful way. The study provides a good basis to evolve a development strategy for accelerated and balanced growth of the economy.

DEDICATED TO

MY

BELOVED PARENTS

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CHAPTER 1

INTRODUCTION

Economic development implies a process of transformation and it is closely linked with structural change resulting from the interaction of supply and demand factors. The transformation of an economy during the process of economic development from a low productivity, predominantly rural, agrarian economy to one predominantly urban, industrial with increased productivity is not automatic. It is a gradual process. According to Syrquin (1986), structural change which is intimately related to economic development can retard growth if its pace is too slow or its direction inefficient. On the other hand, it can contribute to growth if it improves the allocation of resources. Government policies have a big role to play in influencing the extent and direction of structural change and economic development of a country.

Today, in India, we have come far and have made considerable progress since planning for development started. We have achieved much, but have created potentials for much more, and it is necessary to take stock of this from time to time. It is necessary to analyse some broad macro dimensions of growth of the Indian economy for discerning trends and the nature of growth. A discussion of the main features and broad movements of the Indian economy since independence at a macro and aggregative level will explain the extent and direction of growth and structural changes that have been taking place in the Indian economy. Such a

discussion will bring out the necessity of conducting a detailed study of growth and structural change in India.

1.1 MAIN FEATURES OF DEVELOPMENT OF THE INDIAN ECONOMY

During the planned economic development of India, significant changes have taken place in the structure of the Indian economy. The share of the primary sector at constant prices has gone down in the Net Domestic Product (NDP) whereas the share of the secondary and the tertiary sectors have gone up over the period 1950-51 to 1989-90. We find that the average annual share of the primary sector in the NDP fell from about 57 percent in 1950-51 to 34 percent in 1989-90. The secondary sector increased its share from about 16 percent in 1950-51 to about 27 percent in 1989-90 and the tertiary sector from approximately 27 percent to approximately 39 percent over the same period. The growth rate of Net National Product (NNP) at constant prices was around 3 percent in the first three decades while it was around 5 percent in the eighties. In other words, the decade of eighties witnessed a distinctly higher growth rate. As regards the sectoral rates of growth, we find that the growth rates of the secondary and the tertiary sectors over the period 1950-51 to 1989-90 has been more than double that of the primary sector. An important feature of growth in India has been a slackening of the rate of industrial growth in the sixties and the seventies indicating some measure of retrogression in the inter-sectoral growth of the Indian economy during that period. However, the rate of growth picked up in the eighties both in respect of the NNP as a whole and of its three sectors.

Thus, over the period 1950-51 to 1989-90 as a whole, mainly due to the planned efforts of the government, the Indian economy become less geared to the primary sector and more attuned to the secondary and tertiary sectors. This may be regarded from the development point of view as a progressive change in the structure of the Indian economy during this period.

However, corresponding changes in the occupational structure of the workforce which is an allied aspect of the structure of the economy does not confirm this finding. During the first three decades there was practically no change in the proportion of the working population engaged in the primary, secondary and tertiary sectors. This was not in keeping with the structural progress shown by the changes in the share of NDP of the three sectors. This is what constitutes both the problem and the paradox of Indian economic development and has led to the controversy about the linkage between growth and employment and the disillusion with industrialisation as a means for increasing employment and changing the sectoral composition of the workforce (Rao, 1983). Further, it shows that the productivity per worker in the primary sector has not kept pace with the growth of its NDP share, unlike in the secondary and tertiary sectors. However, the 1981 census shows that, finally, the occupational structure has started responding to the change in the NDP sectoral shares. Thus, the share of the primary sector in the total number of workers showed a marginal decline from about 72 percent in 1971 to about 69 percent in 1981.

As regards the structural change in the distribution of the

NDP between the commodity and non-commodity sectors, the latter (which is the same as the tertiary sector) has been growing much faster than the commodity sector during each decade as well as over the period as a whole. This is primarily due to the inadequate growth of the secondary sector, especially manufacturing and construction, rather than the failure of the agricultural sector. It is this which constitutes a major part of the explanation for the growth of poverty and unemployment in our country inspite of the government's planned efforts towards accelerating India's economic development.

The external sector in the Indian economy has a strategic place in the process of economic development. India's international trade, exports and imports taken together constitutes about 10 percent of her national income. In the late fifties and early sixties India adopted import substituting industrialisation as a strategy of economic growth. Different types of industries were established behind the wall of protection. But by the end of the sixties India reached the limit in the form of stagnation in exports and growing gap in the balance of payments. The import bill continued to rise as imports necessary for the maintenance of the newly established industries continued to increase. This situation induced the policy makers to also give stress to export promotion in order to increase exports so that the balance of payments remained under manageable proportions (Panchmukhi and Brahmananda, 1987).

India's imports have always been larger than her exports and the gap between imports and exports has been considerably widening after 1977-78. This has been largely due to the

increased cost of imports of petroleum and oil products. Though India's balance of trade has been by and large adverse, the magnitude of deficit increased abruptly in 1979-80 at current prices on account of the effects of two oil price shocks of 1974 and 1979. The unit value index of imports has been consistently rising since 1973-74, while the unit value index of exports has shown only a moderate rising trend.

The percentage share of imports in India's total GDP has been distinctly increasing since 1974-75 after a fluctuating tendency. In case of the percentage share of exports in GDP, it gradually declined to the lowest point in 1971-72 from 1960-61, and again picked up to reach a new height in 1976-77 after which it has shown a declining trend. India's exports as a percentage share of total world exports was above 1 percent till 1966-67. It gradually declined after that and has never been able to pick up.

Overall we see that changes in the structure of India have been faster during the eighties than during the earlier periods. This is one of the consequences of a significant step up in growth in the eighties as compared to the earlier periods.

In the following we will take up the different macro dimensions of growth and structural changes, that have been taking place in India since independence, in some detail.

1.2 GROWTH AND STRUCTURAL CHANGE IN THE INDIAN ECONOMY

During the 39 years from 1950-51 to 1989-90 the real national income of India increased by about 350 percent. During the same period India's population increased by about 132 percent. As a result the per capita real income increased by only

95 percent. This implies a rather low growth rate of real per capita income - barely 1.7 percent per annum. Table 1.1 gives the compound annual rate of growth of aggregate and per capita Gross National Product (GNP) and real national income between 1950-51 and 1989-90.

Table 1.1

Compound Annual Growth Rate of Aggregate and Per Capita GNP and Real National Income : 1950-51 to 1989-90 (Percentages)

Time Period	GNP at Current Prices Annual Growth Rates (%)		Population	NNP at Factor Cost (At 1980-81 Prices) Annual Gr. Rates (%)	
	Aggregate	Per Capita	Annual Growth Rate (%)	Aggregate	Per Capita
1950-51 to 1960-61	5.6	3.6	1.9	3.8	1.8
1960-61 to 1970-71	10.3	7.9	2.2	3.4	1.2
1970-71 to 1980-81	12.3	9.7	2.3	3.0	0.7
1980-81 to 1989-90	14.1	11.8	2.1	5.2	3.0
1950-51 to 1989-90	10.5	8.2	2.1	3.9	1.7

Source : Economic Intelligence Service (1991), CMIE, Table 8.1-1

From Table 1.1 it can be seen that during the 39 years ended 1989-90, GNP at current prices increased by 10.5 percent annually while in real terms it increased by only 3.9 percent at 1980-81 prices. On the other hand, per capita income at current prices increased by 8.2 percent annually over the same period while at 1980-81 prices it increased by only 1.7 percent due to an annual growth rate of 2.1 percent in population. The growth rate in real

national income showed a decline in the sixties and seventies as compared to the fifties. However, the growth rate picked up after that and the eighties show a significantly higher growth rate of 5.2 percent in real terms annually as compared to the earlier periods.

As regards the sectoral distribution of the national income, there has been a significant change in the structure of the Indian economy in terms of sectoral distribution of the Net Domestic Product (NDP). Table 1.2 provides a breakup of the NDP by industrial origin at constant (i.e. 1980-81) prices.

It is evident from Table 1.2 that the contribution of agriculture to NDP has significantly decreased from 57 percent in 1950-51 to 40 percent in 1980-81 and further to 34 percent by 1989-90. The share of manufacturing increased sharply from 16.2 percent to 26.8 percent over the same period. There has been a noteworthy increase in the share of the tertiary (or non-commodity) sector from 26.6 percent in 1950-51 to 39.2 percent in 1989-90. Within this group the increase in the contribution of the subgroup transport, communication and trade has been significant from 10 percent to 18 percent over the same period. The structural change in the composition of national income by industrial origin is the consequence of the process of economic growth initiated during the plans. Since the growth process involved a rapid expansion of manufacturing in the organised sector, the share of manufacturing was bound to indicate a relatively sharp increase as compared to agriculture.

Table 1.2

Share of Net Domestic Product by Industry of Origin for the Periods 1950-51, 1960-61, 1970-71, 1980-81 and 1989-90 (At 1980-81 Prices)

Sectors	Share in Total NDP (%)				
	1950-51	1960-61	1970-71	1980-81	1989-90
I. Agriculture etc.	57.2	52.7	46.5	40.0	34.0
II. Mining, Manufacturing etc.	16.2	19.5	22.4	24.3	26.8
III. Transport, Communication Trade etc.	10.6	12.4	13.8	16.4	18.0
IV. Finance & Real Estate	7.3	7.1	7.3	8.4	9.8
V. Community & Personal Services	8.6	8.4	9.9	11.0	11.5
Commodity Sectors (I + II)	73.4	72.2	68.9	64.3	60.8
Non-Commodity Sectors (III + IV + V)	26.6	27.8	31.1	35.7	39.2
Net Domestic Product	100	100	100	100	100

Source : Economic Intelligence Service (1991), CMIE, Table 8.5

Table 1.3 gives the compound annual growth rates of NDP generated by the different sectors.

It is evident from Table 1.3 that the rate of growth of real output in agriculture during 1950-51 to 1989-90 was of the order of 2.5 percent per annum while the share of manufacturing during the same period increased at the rate of 5.2 percent per annum. Similarly, the rate of growth of trade, transport and

communication was also of the order of 5.2 percent between 1950-51 to 1989-90. The growth rate of the tertiary sector on the whole was 4.9 percent during the same period. Table 1.3 also clearly shows a slow down in the growth rates of the primary and secondary sectors in the sixties and the seventies corresponding to the slowdown in the growth rate of the NDP as a whole during

Table 1.3

Rates of Growth of Net Domestic Product at Factor Cost (At 1980-81 Prices)

Activity	Compound Annual Rate of Growth (%) Between				
	1950-51 & 1960-61	1960-61 & 1970-71	1970-71 & 1980-81	1980-81 & 1989-90	1950-51& 1989-90
I. Agriculture etc.	2.9	2.2	1.3	3.5	2.5
II. Mining, Manufacturing etc.	5.7	5.0	3.7	6.5	5.2
III. Transport, Communication Trade etc.	5.3	4.7	4.6	6.5	5.2
IV. Finance & Real Estate	3.5	3.8	4.3	7.3	4.6
V. Community & Personal Services	3.5	5.2	3.9	5.9	4.6
Commodity Sectors (I + II) Overall Growth	3.6	3.0	2.2	4.7	3.3
Non-Commodity Sectors (III + IV + V) Overall Growth	4.3	4.6	4.3	6.5	4.9
Net Domestic Product	3.8	3.5	2.9	5.4	3.8

Source : Economic Intelligence Service (1991), CMIE, Table 8.5

the same period. Thus over the period 1950-51 to 1989-90 as a whole, the Indian economy reduced its dependence on the primary sector and became more geared to the secondary and the tertiary sectors; and in terms of percentage growth between the two, slightly more to the secondary than to the tertiary sector. Another interesting aspect of structural change in India has been a significant change from a subsistence to a market oriented economy. This change can be seen from Tables 1.2 and 1.3 by the increasing role of trade, transport, communication and banking in the NDP over the period of 39 years under consideration.

The theory of economic growth (Rostow, 1960) also supports the structural change in the composition of the national product. While the developed economies are predominantly industrial in their structure, developing economies like India are predominantly agricultural. As industrialisation spreads it brings an improvement in the share of industry and services and a decline in the share of agriculture. The Indian economy is passing through such a process of transition from an agricultural economy to an industrialised one. This structural change is taking place though at a slow pace.

The changing structure of national income in India needs to be further strengthened by stepping up the programme of industrialisation. This does not imply a neglect of agriculture, but for accelerating the growth process in agriculture, industrialisation of the economy with emphasis on agrobased industries supplying inputs to agriculture is a must. In fact as long as India's problem of poverty is unresolved, an accelerated

growth of output in the commodity sectors as compared to the non-commodity sectors should be the central preoccupation of the planning process in India (Economic Intelligence Service, 1990).

Next we come to changes in the composition of India's final demand. Table 1.4 presents the percentage shares of consumption, investment, exports and imports in India's Gross Domestic Product at market prices for 1970-71, 1980-81, 1984-85 and 1986-87.

Table 1.4

Composition of Final Demand (Gross Domestic Product at Market Prices) (At Current Prices)

Demand Factors	Percentage Share			
	1970-71	1980-81	1984-85	1986-87
Govt. Final Consumption Expenditure	9.4	9.6	10.6	12.0
Private Final Consumption Expenditure	74.0	72.1	69.8	67.2
Gross Fixed Capital Formation	15.7	19.3	19.6	21.6
Change In Stocks	2.6	3.5	3.5	2.7
Export of Goods& Services	4.4	6.6	6.9	5.8
Less Imports of Goods & Services	-4.5	-10.0	-8.4	-7.7
Discrepancies	-1.6	-1.2	-1.9	-1.6
Total Final Demand or (Total Expenditure on Gross Domestic Product)	100	100	100	100

Source : Chandhok and The Policy Group, India Database, The Economy, Vol.1 (1990), Table 1.62 and Table 1.204

From Table 1.4 it can be seen that over the period 1970-71 to 1986-87, the import share in total final demand grew

consistently, from 4.5 % in 1970-71 to 7.7 % in 1986-87. Along with the import share, the export share in total final demand also rose from 4.4 % in 1970-71 to 5.8 % in 1986-87. The share of investment also increased substantially from 18.3% in 1970-71 to 24.3% of GDP in 1986-87. By contrast, the share of private consumption declined from 74% in 1970-71 to 67.2% in 1986-87. Government consumption shows a marginal increase in its share over the period 1970-71 to 1986-87. In short, the Indian economy is experiencing a significant increase in the role of foreign trade though consumption and investment continue to maintain a very large share of final demand.

The major items of private final consumption expenditure are food, beverages and tobacco, clothing and footwear, gross rent, taxes, fuel and power, furniture, furnishings, household equipment and operation, medical care and health expenditure, transport and communication and recreation, entertainment, education and cultural services. Table 1.5 gives the changes in the private final consumption expenditure by object over the period 1950-51 to 1987-88.

Table 1.5 shows that food items constitute the major chunk of private final expenditure. There is a steady decrease in the share of food items from 65.5% in 1950-51 to 54.4% in 1987-88 and in the share of gross rent etc. from 17.2% to 11.6% over the same period. The share of all other items shows a steady increase between 1950-51 and 1987-88. The share of clothing & footwear and transport & communication more than doubled, from 5.4% in 1950-51 to 12.6% in 1987-88 for clothing & footwear and from 2.6% in 1950-51 to 7.3% in 1987-88 for transport & communication.

Table 1.5

Private Final Consumption In The Domestic Market By Object : Percentage Distribution (At 1980-81 Prices)

Item	Percentage Distribution				
	1950-51	1960-61	1970-71	1980-81	1987-88
Food, Beverages & Tobacco	65.5	66.4	62.6	58.9	54.4
Clothing & Footwear	5.4	7.1	8.8	11.2	12.6
Gross Rent, Taxes, Fuel & Power	17.2	14.2	12.9	12.4	11.6
Furniture, Furnishings, Household Equipment & Operation	2.2	2.4	3.1	2.8	3.7
Medical Care & Health Expenditure	1.3	1.6	2.4	3.0	2.6
Transport & Communication	2.6	2.8	3.7	5.2	7.3
Recreation, Entertainment, Education & CulturalServices	2.0	1.9	3.3	3.0	3.1
Misc. Goods & Services	3.8	3.6	3.2	3.5	4.7
Private Final Consumption Expenditure in Domestic Market	100	100	100	100	100

Source : Chandhok and The Policy Group, India Database, The Economy, Vol.1 (1990), Table 1.148(b)

There have been changes in the structure of gross capital formation by industry of use also. Table 1.6 gives the percentage

share of gross capital formation by industry of use for 1950-51, 1960-61, 1970-71, 1980-81 and 1987-88.

Table 1.6

Gross Capital Formation by Industry of Use
(Percentage Distribution)
(At 1980-81 Prices)

Activity	Percentage Distribution				
	1950-51	1960-61	1970-71	1980-81	1987-88
Agriculture	22.8	15.1	20.0	19.8	11.3
Mining & Quarrying	0.9	1.6	2.2	3.6	6.6
Manufacturing	18.3	28.2	29.8	28.5	26.0
a) Registered	16.5	25.6	23.2	21.8	19.0
b) Unregistered	1.8	2.7	6.6	6.7	7.0
Electricity, Gas & Water Supply	2.4	4.3	9.2	10.5	13.5
Construction	0.7	3.9	2.6	2.3	1.8
Trade, Hotels & Restaurants	12.6	6.0	2.9	5.9	8.7
Transport, Storage & Communication	11.1	12.7	10.8	9.5	12.7
Finance, Insurance, Real Estate & Business Service	21.2	14.2	13.3	11.0	9.6
Community, Social & Personal Services	10.0	13.9	9.4	8.9	9.8
Total Gross Capital Formation	100	100	100	100	100

Source : Chandhok and The Policy Group, India Database, The Economy, Vol.1 (1990), Table 1.153(b)

From Table 1.6 we observe the following trends :-
The share of agriculture shows a steady decline in the total gross capital formation from 22.8% in 1950-51 to 11.3% in 1987-88. Similarly the shares of trade, hotels & restaurants and finance etc. show a declining trend over the same period. On the other hand, the shares of manufacturing and electricity, gas & water supply show a steady upward trend. The share of manufacturing in total gross capital formation increased from 18.3% in 1950-51 to 26% in 1987-88 while that of electricity etc. rose by six times from a mere 2.4% in 1950-51 to 13.5% in 1987-88. Such a change is in keeping with the changing NDP shares of the primary and secondary sectors. Services, in general do not show much change in its share. This is due to the fact that capital formation in services is mainly of fixed capital like construction, machinery and equipment which normally last for a long period.

Tables 1.7 and 1.8 show the changes in the structure of India's exports and imports.

The data given in Table 1.7 reveals that traditional exports dependent upon agriculture and mineral wealth accounted for 42% of total exports in 1970-71. Their share however declined to about 32% in 1987-88. As against this, the share of manufacture in total exports has gone up from about 50% in 1970-71 to about 63% in 1987-88. There is a sharp increase in the share of mineral fuels and lubricants from about 1% in 1970-71 to about 4% in 1987-88. Obviously the structure of Indian exports in changing in favour of manufactured goods and mineral fuels whose combined

share has gone up from about 51% in 1970-71 to about 67% in 1987-88.

Table 1.7

Exports by Major Commodity Groups (Percent of Total Exports)

Category	Percentage Share		
	1970-71	1980-81	1987-88
Agriculture & Allied Products	31.7	30.7	27.7
Ores & Minerals	10.7	6.2	4.5
Manufactured Goods	50.3	55.8	62.9
Mineral Fuels & Lubricants	0.8	0.4	4.2
Others	6.5	6.9	0.7
Total Exports	100	100	100

Source : Chandhok and The Policy Group, India Database, The Economy, Vol.2 (1990), Table 6.11

The structural changes in imports show increasing imports of capital goods and raw materials due to rapid growth of industrialisation. From Table 1.8 it can be seen that the share of raw materials rose significantly from 20.2% in 1964-65 to 65.2% in 1987-88. The share of capital goods was very high in 1964-65 that is, about 49% while in 1987-88 it was 28% of total imports. The imports of raw materials was low in 1964-65 (Third Plan Period), because, at that time, the country was industrialising herself through setting up new industries and accordingly the demand for capital goods was high then but the demand for raw materials would only come later. The imports of

consumer goods show a declining trend from 21% in 1964-65 to only 4.3% in 1987-88. This is due to our country becoming self-sufficient in foodgrains and consumer goods through agricultural and industrial growth.

Table 1.8

Structure of Indian Imports (Percent of Total Imports)

Category	Percentage Share			
	1964-65	1970-71	1980-81	1987-88
Consumer Goods	20.9	14.8	3.0	4.3
Raw Materials & Intermediate Manufactures	20.2	54.4	77.8	65.2
Capital Goods	49.3	24.7	15.2	28.1
Others :Unclassified	9.6	6.1	4.0	2.4
Total Imports	100	100	100	100

Source : Chandhok and The Policy Group, India Database, The Economy, Vol.2 (1990), Table 6.12

Indian imports are much higher than Indian exports. In 1987-88 exports constituted 5.2% of GNP at market prices while imports were 7.4% of GNP. India's trade deficit has been increasing since 1950-51 which is not a healthy trend. The policy of import liberalisation since the late 1970s has further widened the trade deficit which increased from 0.5% of GNP in 1950-51 to 4.6% of GNP in 1980-81. In 1987-88 the trade deficit was equal to Rs. 6658 crores which constituted 2.2% of India's GNP (Chandhok and The Policy Group, 1990, Vol. 2, Table 6.13). India's exports as a percent of world exports has declined from 1.88% in 1950-51 to 1.03% in 1960-61, to 0.63% in 1970-71 and further to 0.5% in

1987-88 (Chandhok and The Policy Group, 1990, Vol. 2, Table 6.13).

Another feature of structural change in India is the change in the structure of factor incomes. Table 1.9 shows the factor income distribution for the period 1970-71 to 1984-85.

Table 1.9

Structure of Factor Incomes (Percent of Total)
(At Current Prices)

Factor Income	Percent of total											
	1970-71				1980-81				1984-85			
	P*	S	T	Total	P	S	T	Total	P	S	T	Total
Compensation of Employees	22.6	57.7	53.1	38.7	24.2	52.5	51.8	40.8	23.1	53.0	53.7	42.2
Interest	3.2	10.8	5.0	5.2	5.7	16.3	4.9	7.8	6.2	18.6	5.0	8.6
Rent	2.4	1.4	11.9	5.1	1.2	1.9	8.6	4.1	1.5	1.7	6.5	3.5
Profits & Dividends	2.2	10.9	3.5	4.3	2.1	10.1	3.8	4.5	4.8	10.6	4.5	6.0
Mixed Income of Self Employed	69.6	19.2	26.1	46.7	66.8	19.2	30.9	42.8	64.4	16.1	30.3	39.7
Net Domestic Product				100				100				100

* P stands for Primary, S stands for Secondary and T for Tertiary Sectors

Source : Chandhok and The Policy Group, India Database, The Economy, Vol.1 (1990), Table 1.8 (b).

A traditional economy is marked more by self employment than

by employment on wages and salaries. As the economy develops the share of the former in the total factor income declines while that of the latter increases. The development of the Indian economy in this direction also is revealed by Table 1.9. Table 1.9 shows that for the period 1970-71 to 1984-85, employee compensation in the form of actual payments to labour (excluding self employed) was between 38% to 43% of NDP in all the years and shows an upward trend in 1984-85 as compared to 1970-71 and 1980-81. Mixed income of self employed shows a declining trend from 46.7% in 1970-71 to 39.7% in 1984-85. Profits and dividends also show an increasing trend from 4.3% in 1970-71 to 6% in 1984-85. Rent and interest taken together accounted for about 10% of the total factor income in 1970-71 while in 1984-85 their share was about 12%. Whereas rents show a tendency to decline, the share of interest shows an increasing trend. A closer analysis of factor income distribution from Table 1.9 reveals that, of the total factor income generated in the primary sector, more than 60% contribution comes from mixed income of self-employed for all the three years while compensation to employees has the major share (more than 50%) in the total factor income of the secondary sector. For the tertiary sector also the major contribution comes from employee compensation. Of the three sectors, interests and profits and dividends have the largest share in the secondary sector while rent has the largest share in the tertiary sector for all the three years.

Next we shall analyse the economic growth in the Indian economy in terms of growth of output in agriculture, industry and

energy since 1950-51. Table 1.10 gives these aspects of India's economic growth.

Table 1.10

Growth of Output : 1950-51 to 1990-91

	1950-51	1960-61	1970-71	1980-81	1990-91	Annual Rate of Increase (%) Between 1950-51& 1989-90
Index of Industrial production (1980-81 = 100)	18.3	36.2	65.3	100.0	212.9	5.9
Index of Agricultural Production (1969-70=100)	58.5	86.7	111.5	135.3	186.4*	2.7
Foodgrains (Million tonnes)	50.8	82.0	108.4	129.6	177.2	2.8
Finished steel (Million tonnes)	1.04	2.39	4.64	6.82	13.40	6.4
Cement (Million tonnes)	2.7	8.0	14.3	18.6	48.7	7.5
Coal including lignite (Million tonnes)	32.3	55.2	76.3	119.0	223.5	4.8
Crude oil (Million tonnes	0.3	0.5	6.8	10.5	33.0	12.5
Electricity generated (utilities only) (Billion kwh)	5.1	16.9	55.8	110.8	264.2	10.4

* Relates to 1989-90

Source : Economic Survey, 1990-91, page S-1 and Economic Intelligence Service (1991), CMIE, Key Indicators of India's Economic Growth 1950-51 to 1990-91.

From Table 1.10 we see the progress India has made on the

agricultural and industrial fronts. Between 1950-51 and 1990-91 production of foodgrains has increased by about 248% from 50.8 million tonnes in 1950-51 to 177.2 million tonnes in 1990-91. Good progress has been made in the agricultural sector since the First plan, even though, the original targets fixed in each plan were not achieved at all. The annual rate of growth in foodgrains between 1950-51 and 1990-91 was only 2.8%. A lot of progress has been made on the industrial front too as can be seen by the growth of the industrial output of selected commodities from Table 1.10. Today India is one of the most industrialised countries of the world. The industrial structure has become widely diversified covering broadly the entire range of consumer, intermediate and capital goods. Industrial growth has not been uniform since 1950-51. After a steady growth of about 6% during 1950-51 to 1970-71 the growth rate slowed down to 4.2% during 1970-71 and 1980-81. During 1980-81 to 1990-91 the growth rate increased to 7.9% per annum. Overall the rate of growth of industrial output was 5.9% per annum between 1950-51 and 1990-91.

Before we conclude this section it is necessary to give a brief picture of price movements in India as well as the changes in the employment structure of India since 1950-51.

Price movements are significant in studying the growth of an economy. First of all, price variations indicate the general economic conditions in the country. They tell us the value of money and how different sections of people are affected. Secondly, price movements are significant to the Government for they indicate the nature of control and regulatory measures which the Government has to adopt. Finally, in the context of economic

development of a large and predominantly agricultural country like India, price policy is extremely significant since the successful implementation of the plan projects depend largely on the Government control of prices.

The following table gives the index numbers of wholesale prices in India since 1951.

Table 1.11

Index Numbers of Wholesale Prices : 1950 to 1990
(Base : 1981-82 = 100)

Year	Index	Percentage Change over Previous Year	Annual Rate of Increase (%) Between	
1950	16.2	5.2	1950 & 1960	12.9
1955	14.1	-9.4	1960 & 1970	6.2
1960	18.9	6.2	1970 & 1980	9.6
1965	24.9	8.3	1980 & 1990	7.4
1970	34.6	6.1	1950 & 1990	6.2
1974	59.1	28.5		
1978	64.6	-0.3		
1980	86.7	20.2		
1985	124.0	4.6		
1990	176.7	8.7		

Source : Economic Intelligence Service (1991), CMIE, Table 18.8

Even though the price level in India has been steadily rising ever since economic planning was initiated in 1951 (as can be seen from Table 1.11), the rise in prices since the Fourth plan (1969-70 to 1973-74) has been extremely significant. Besides other factors, a fourfold increase in oil prices towards the end of 1973 resulted in an unprecedented rise in the price level of 1974 in which prices increased by 28.5% over the previous year. The Janta Government was successful in holding the price line reasonably well during 1977 to 1979. Since 1980 the price level

has continued to rise despite all the steps taken by the Government to control it. During the eighties prices rose by 7.4% annually. As a consequence of the continuous rise in prices the value of one rupee today is 8 paise in terms of the 1950 purchasing power of the rupee. The imbalance of demand and supply is the main cause of Indian inflation. Taking the economy as a whole, the index of money supply is a reasonably good measure of aggregate demand and the index of real national income is a good measure of aggregate supply. During 1960-61 and 1990-91 money supply increased at an annual rate of 12.3% whereas the real national income increased by 3.9%. This clearly explains the fact that the inflation of prices is caused by excessive expansion of monetary demand in relation to the available supply of goods and services in the economy. Thus in order to ensure price stability, the rate of expansion of money supply should be roughly equal to the rate of increase of output. A couple of percent points more: but not much more (Economic Intelligence Service, 1991).

As regards demographic changes, the population of India increased from 357 million in 1951 to 837 million in 1991 at an average annual rate of increase of 2.1%. Tables 1.12 and 1.13 show workforce and occupational classification of workforce respectively.

Table 1.12 shows that the workforce participation rate rose from 39% in 1951 to 43% in 1961. Thereafter it declined and was approximately 33% in 1971 and 1981. This contradictory trend can be explained by the fact that the concept of "worker" or labour

force has been changing in the different censuses[1]. In 1991 the workforce participation rate was 37.6%. The direct comparisons of the 1981 & 1991 figures is possible because of the adoption in the 1991 census of almost the same definitions & concepts of the

Table 1.12

Workers and Non Workers : 1951 - 1981

	Million				
	1951	1961	1971	1981	1991
a. Workers *	140 (39)	189 (43)	180 (33)	223 (34)	315 (37.64)
b. Non-Workers	217 (61)	250 (57)	368 (67)	442 (66)	522 (62.36)
Total (a + b)	357 (100)	439 (100)	548 (100)	665** (100)	837*** (100)

Figures in brackets show percentage of total
* i.e all those who participate in any type of economic activity
** Excludes Assam
*** Excludes Jammu & Kashmir

Source : Economic Intelligence Service (1991), CMIE, Table 9.1A & Census of India 1991

1981 census. The data given in Table 1.12 however should be used for comparisons with extreme care and caution because of the above mentioned reasons.

As regards the occupational structure of the Indian economy there has been a marginal shift in the proportion of the working population from agriculture to the secondary and tertiary sectors of the economy. Table 1.13 shows this.

As is evident from Table 1.13, the occupational structure of

1. For details see Census of India, 1991: Provisional Population Totals - Workers & their Distribution, Series 1, Paper 3.

India clearly reflects the backwardness of the Indian economy. Over the period 1951 to 1971 the proportion of working population engaged in the primary sector has been steady around 72%. This is

Table 1.13

Occupational Classification of Workers : 1951 to 1981 (Percent)

	1951	1961	1971	1981*
A. Primary Sector (agriculture, livestock, forestry, fishing, hunting & plantation)	72.1	71.8	72.1	68.8
B. Secondary Sector (mining & quarrying, household industry, other industries, construction)	10.7	12.2	11.2	13.5
C. Tertiary Sector (trade & commerce, transport, storage & communication, other services)	17.2	16.0	16.7	17.7
TOTAL (A + B + C)	100	100	100	100

* Excludes Assam

Source : Economic Intelligence Service (1991), CMIE, Table 9.1B

significant, since a large percentage of population dependent on the primary sector is a clear indication of the prevalence of large scale disguised unemployment in agriculture and consequently of low per capita labour productivity and prevalence of widespread poverty. Over the same period the proportion of working force in the secondary and tertiary sectors has also been constant at around 28%. Only in 1981 there has been a marginal decline of about 3% in the workforce engaged in the primary sector from 72% to 69%. This decline has been absorbed in the

secondary and tertiary sectors whose contribution has increased from around 28% to around 31%. Thus there has been no clear shift in the workforce from the primary to the secondary and tertiary sectors of the country since 1951. That is, the occupational structure is not in keeping with the changing NDP shares of the primary, secondary and tertiary sectors. The experience of developed countries shows that economic development of a country is accompanied by a clear shift of the working population from the primary to the secondary and ultimately to the tertiary sectors of the economy. The development process of India has till date not shown a significant healthy trend on this front.

1.3 PURPOSE OF THIS STUDY

The features of the Indian economy mentioned above give an idea about the extent of growth and structural changes taking place in the economy since the fifties but at a very macro and aggregative level. There have been very few studies and descriptions of structural change in the Indian economy during this period which have analysed Indian economic growth and structural change in detail. The understanding of the structure of an economy in detail is very much essential for its planned development. There is an inherent need for examining the detailed internal structure of an economy and its relationship with the growth of the economy in order to find out whether the two are going hand in hand, that is, whether the extent and direction of structural change is in favour of rapid economic growth of the economy or not. Our interest in this subject greatly stems from this necessity. The purpose of this study is to analyse

structural change and growth in the Indian economy in detail during the period 1968-69 to 1983-84 using the Input-Output tables of India for the years 1968-69, 1973-74, 1978-79 and 1983-84 prepared by the Central Statistical Organisation (CSO). Input-Output tables provide information regarding the production activities of an economy in great detail and are amply suited for structural analysis studies. The selection of the period of fifteen years ranging from 1968-69 to 1983-84 for the purpose of this study has been dictated by the availability of Input-Output tables of the Indian economy.

The present study has been designed in such a way that its findings could be useful in development planning for the Indian economy. It is unquestionably recognised that rapid economic development needs efficient planning. Such economic planning is not possible without knowing the details of the structure of the economy. So, as a first step, there is need to understand the structure and growth of the economy that could provide a framework, for proper allocation of economic resources to attain the object of rapid economic development. The present study is an effort in this direction. More specifically, by comparing Input-Output tables constructed for different years, this study attempts to analyse the nature and implications of changes in the structure of production, in technology, in employment and in costs for the Indian economy over the period 1968-69 to 1983-84 as comprehensively as possible and also attempts to study the relationship of structural changes with the economic growth of the country over the same period.

1.4 CHOICE OF METHODOLOGY

This study relies heavily upon the analytical framework provided by the Input-Output technique. The primary focus of the Input-Output technique is the production side of the economy. The most significant structural relationships in this technique are relationships describing the interdependencies among producing sectors. These relationships are not based upon optimization theories regarding production decisions in the different industries but are instead derived from theories concerning the technology underlying production processes. Variables representing the economic behaviour of consumers and institutional and governmental rules are assumed to be exogenous, that is, determined by factors outside the model.

The technology underlying actual production processes is a very broad concept which encompasses social and cultural factors as well as scientific relationships. It is not possible to record technology accurately in the form of Input-Output data. Thus technology in an Input-Output framework does not include social and cultural factors. Technology is recognised as a central factor in the production process which is expected to remain relatively stable over time. The relative stability of the technological relationships underlying production processes is explained by the fact that technology is embodied in factors of production which are usually fixed in the short term. Although there are certain measures which can be taken to improve efficiency and increase output in the short term, fundamental changes in production processes are by nature long-run issues.

There is a difference between technological change and substitution among inputs. Substitution among inputs refers to changes in the mix of inputs within the context of a given production function while technological change implies changes in the production function itself. In an Input-Output table, the production function for each sector is specified and fixed for the year for which the Input-Output table has been constructed. Changes over time in the relationships among sectors and requirements of primary inputs in the Input-Output table thus reflect the effects of both input substitution and technological change. Since these phemomenon are represented as changes in the structural parameters of the Input-Output model, they are identified as structural change.

The Input-Output technique is not unique in providing a framework for analysing the Indian economy. Numerous other economic models including growth models and econometric models have been used for this purpose. Each of these models differ in terms of the theories upon which they are constructed and the types of issues which they are designed to investigate. It is not our purpose to compare alternative, analytical procedures for analysing the Indian economy. However, it should be stressed that the Input-Output model is better suited for analysing changes in the relationships underlying production processes on several counts. Firstly, Input-Output tables give a much greater level of industrial detail than is available in most other analytical models. Secondly, the Input-Output model encompasses all productive activities and from this perspective can be viewed as being a complete model of industrial production. Finally, in the

Input-Output model government policies, economic behaviour of producers and consumers and foreign trade variables are determined by factors outside the model. This enables attention to be concentrated on the technology of production and the interrelationships among industries in production activities. Hence, owing to the nature of the problem of the present study and the availability of data, the Input-Output approach has been adopted as a methodological choice for analysing growth and structural change in the Indian economy over the period 1968-69 to 1983-84.

The analysis of growth and structural change presented in this study can be described as a comparative, static analysis. The exercises described in the following chapters are primarily concerned with measuring the changes in the structure of production in the Indian economy, assessing the implications of these changes in terms of changes in the requirements of intermediate inputs, employment and costs, and relating structural changes to the economic growth of the economy over the period 1968-69 to 1983-84. This study does not attempt to develop explanations of the causes of structural change which by itself would form a separate research topic.

1.5 ARRANGEMENT OF CHAPTERS

This study consists of ten chapters. Chapters 2 and 3 provide a review of the background literature for the study, explain the specific objectives of the study and present a description of the basic data used in subsequent analysis. In particular, Chapter 2 describes the Input-Output model, gives a

summary of other studies of structural change in an Input-Output framework, describes the specific objectives of the study and explains the steps that have been taken up to meet these objectives.

Chapter 3 discusses the principal characteristics of the Indian Input-Output tables and supplementary employment data collected from different sources which provide the basic data for the purpose of this study and explains the adjustments made to these data to improve their intertemporal comparability.

While Chapter 4 presents a direct, aggregated and overall comparison of the four adjusted Input-Output tables, Chapters 5 - 8 provide detailed, empirical analyses of the extent of structural change in the Indian economy during the period 1968-69 to 1983-84. The analysis presented in Chapter 5 is concerned with analysing changes in the structure of output of sectors and factoring out the sources of output change.

Chapter 6 is devoted to analysing changes in the technology underlying production processes. This is done by measuring changes in the most important Input-Output coefficients. In this chapter the importance of individual coefficients is decided by measuring the effects of a change in individual coefficients on the output of industries.

Chapter 7 examines the structural changes in employment of production sectors and also examines the sources of such change.

In Chapter 8 an analysis of changes in the cost shares of primary inputs and its impact on the prices of the output of different Indian industries over the period under study is

presented. The sources of such change are also examined.

Chapter 9 examines the effect of structural changes, during the period under study, on the economic growth of India over the same period.

A brief summary of the empirical analysis and the limitations and major conclusions of this study are presented in Chapter 10. In presenting these conclusions, suggestions are given for future extentions of this research.

Note : The data given in this Chapter has been taken from the Source - Economic Intelligence Service, 1991. For data not taken from this issue, the sources have been mentioned.

CHAPTER 2

THE INPUT - OUTPUT APPROACH, REVIEW OF LITERATURE AND OBJECTIVES OF THE STUDY.

The purpose of this chapter is to review and summarize the background literature for this study, to explain the specific objectives of the study and also to briefly explain the Input-Output technique. This chapter is divided into three sections. The first section presents a discussion on the nature of Input-Output analysis. The second section presents a review of the principal contributions to the study of structural analysis in an Input-Output framework while the final section describes the specific objectives of the study and explains the steps that have been taken up in the study to meet these objectives.

2.1 THE INPUT-OUTPUT APPROACH

The development of the Input-Output approach as a technique for studying economic interdependence began with the work of Wassily Leontief in the 1930's (Leontief, 1936 and Leontief, 1960). The idea of interdependence among the different producing and consuming units was first proposed in the General Equilibrium Theory of Leon Walras (Walras, 1954 and Kuenne, 1954). Walras explained the equilibrium in the economy by means of a set of production functions for the different producing units, a set of consumption functions for the consumers, the total supply and demand for commodities and factors of production. But his model was too complicated to be used in empirical studies and remained unused until Professor Leontief invented the tool of Input-Output

analysis and applied it to the data available for the American economy during the 1930s.

Leontief's Input-Output technique deals with the quantitative analysis of the interdependence among various producing sectors of an economy as well as the final consuming sectors. An Input-Output table forms the basis for such analysis. In the next sub-section we will explain such a table in some detail.

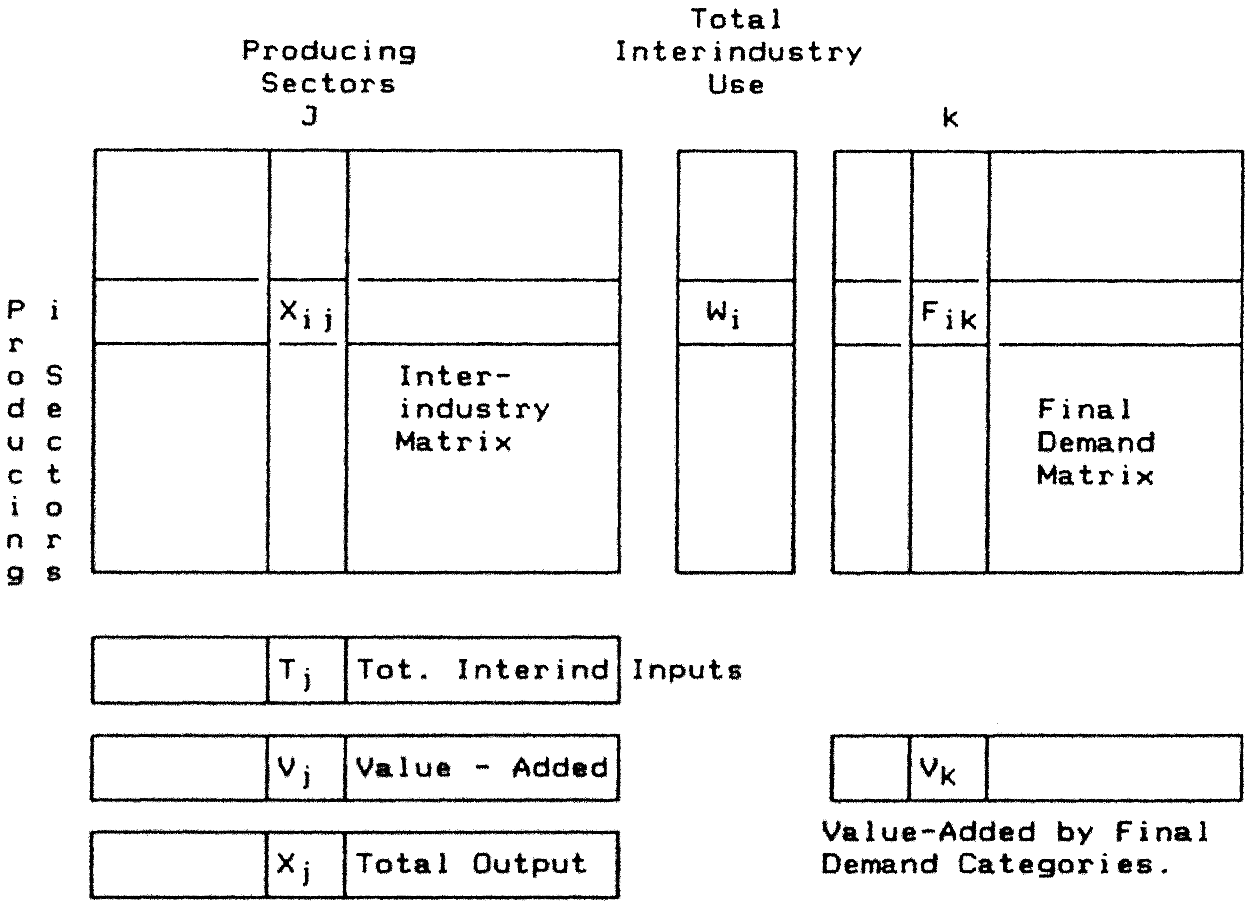
2.1.1 The Input-Output Table & Fundamental Relationships

The Input-Output table of an economy shows the flow of goods and services from a sector of the economy to all the other sectors over a specified period of time (usually a year). It gives the systematic description of interdependence of different sectors of the economy by way of a two-way table. The rows of the table describe the distribution of outputs of sectors to purchasing sectors and final users, while the columns describe the purchases of intermediate and primary inputs by the different sectors of the economy. A representative Input-Output table is shown in Fig. 2.1. All entries shown in the table are in value terms.

The distinction between intermediate users (i.e. used by producing sectors) and final users (i.e. for direct consumption) of industrial outputs, and intermediate inputs (i.e. produced inputs) and primary inputs (i.e. inputs not being produced), enables the transactions in an Input-Output table to be classified into four different types. First, the transactions among producing sectors comprise the major portion of the Input-

Figure 2.1

The Input-Output Table



Output table. These transactions are represented in Figure 2.1 as the delivery of the output of sector i to sector j, denoted as X_{ij}. Since each sector in this table is represented once as a producing industry and once as a consuming industry, these transactions form a square matrix. The sum of the deliveries of the output of sector i to all producing sectors, including itself, is represented as W_i in the column vector of total intermediate use. Similarly the sum of all intermediate inputs purchased by sector j, including the purchase of its own outputs, is represented as T_j in the row vector of total intermediate

inputs.

The deliveries of sectoral outputs to final demand represent the second kind of transactions recorded in Input-Output tables. The categories of final demand include private consumption, government consumption, investment, inventories, exports and imports. In Fig. 2.1 the sectoral deliveries to final demand are shown as the output of sector i delivered to the kth category of final expenditures, denoted as F_{ik}.

The third type of transactions recorded in Input-Output tables refer to the purchases of primary inputs by producing sectors. In the Input-Output framework primary inputs include those inputs whose production is not described in the system. Thus labour, land and capital stock are commonly regarded as primary inputs in Input-Output models. The payments for primary factors of production corresponds to the concept of value added. These transactions are represented in Fig. 2.1 as V_j where j refers to the jth producing sector.

The final type of transactions shown in Fig. 2.1 is the payment for primary inputs by final expenditure categories. These transactions are represented as V_k. The inclusion of these transactions is necessary in order for the total of an Input-Output table to be consistent with national income and product aggregates.

The total production of sector i, denoted as X_i, is defined as the sum of the deliveries of the output of sector i to all producing sectors and final users. That is,

$$X_i = \sum_{j=1}^{n} X_{ij} + \sum_{k=1}^{m} F_{ik} \qquad (i=1,2,\ldots,n) \qquad - 2.1$$

Since the total sectoral production is equal to the total cost of production in each sector in the Input-Output table the row sum is equal to the column sum for a given industry. Thus,

$$\sum_{j=1}^{n} X_{ij} + \sum_{k=1}^{m} F_{ik} = \sum_{i=1}^{n} X_{ij} + V_j \qquad (i=1,\ldots,n,\ j=1,\ldots,n) \qquad - 2.2$$

Furthermore, the sum of all intermediate deliveries plus the sum of all deliveries to final demand must be equal to the sum of all intermediate deliveries plus the sum of value added or,

$$\sum_{i=1}^{n} \sum_{j=1}^{n} X_{ij} + \sum_{i=1}^{n} \sum_{k=1}^{n} F_{ik} = \sum_{j=1}^{n} \sum_{i=1}^{n} X_{ij} + \sum_{j=1}^{n} V_j \qquad - 2.3$$

It follows from equation (2.3) that the sum of value added is equal to the sum of all deliveries to final users. That is,

$$\sum_{j=1}^{n} V_j = \sum_{i=1}^{n} \sum_{k=1}^{m} F_{ik} \qquad - 2.4$$

The identities and equations described above represent the most important ones for the purpose of this study. Other accounting relationships will be described as they are used in the later chapters.

The initial statement of Leontief's Input-Output model portrayed a closed self-contained system in which all expenditures were associated with purchases of inputs in production processes. In this formulation, personal consumption

expenditures were identified as inputs in the household industry which provided labour and entrepreneurial services as its corresponding output. (For simplicity it was assumed that there is no external trade or government activity affecting the economy). Such a model is called the closed Input-Output model. In subsequent work, Leontief modified this system by treating personal consumption expenditures as exogenous and extending the exogenous expenditure categories to include investment, external trade, and government purchases. This modified Input-Output model is generally known as an open system since it assumes that factors outside the model, that is, behaviour patterns of consumers etc., are responsible for determining the level and composition of final expenditures. The open Input-Output model has a wider application in empirical studies than the closed model. In this study we shall be exclusively concerned with the open Input-Output model.

2.1.2 Assumptions of Input-Output Models

One of the important uses of an Input-Output table is in the area of analysing and predicting the performance of an economy. Before an Input-Output table can be used for these purposes, it must be converted from a descriptive device into an analytical model. For this, the Leontief Input-Output model makes several assumptions which are discussed in the following paragraphs.

The essential assumptions of Input-Output theory are almost entirely concerned with the nature of production. Input-Output theory assumes that each sector produces a single homogeneous output with a single input structure and there is no substitution

between the outputs of different sectors. The basic structural unit of this model is the industry or producing sector which is assumed to represent an aggregation of firms producing homogeneous outputs and employing similar techniques in production. This assumption allows each commodity to be associated with a particular industry.

The second assumption states that there is fixed proportion of the Leontief production function. In other words, the quantity of each input used by any sector is a constant proportion only of the level of output of that sector, that is, the amount of each kind of input utilised by a sector varies in direct proportion to its output. This assumption implies that all production processes exhibit constant returns to scale and there is no substitution among inputs in a given production process.

The third assumption states that the Hawkins-Simon (1949) condition must be satisfied by the Input-Output table. This condition ensures that the level of gross output in each sector is adequate to meet the intermediate and final demands for that sector or alternatively the output X_i should not be less than the direct and indirect requirements of the output of this sector.

Furthermore, it is assumed in the Input-Output model that there are no externalities among production activities. In other words, the sum of the inputs used in the production of several commodities is the same as the sum of the inputs used in the production of each separate commodity.

Although these assumptions are very rigid it should be stressed that the overall usefulness of the Input-Output model is

not determined by the validity of its assumptions, but rather by the accuracy with which it can predict certain economic events (Friedman, 1953)[1].

2.1.3 The Input-Output Model

From the transaction or interindustry matrix, as described above, the technical coefficient matrix can be derived. The technical coefficients describe the amount of each input required in the production of a given unit of output. These coefficients are derived as:

$$a_{ij} = \frac{X_{ij}}{X_j} \qquad - 2.5$$

The technical coefficients are arranged in a matrix, following the same format as the transactions matrix in the Input-Output table. This matrix is called the technical coefficient matrix and is denoted as A, where

$$A = \begin{bmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ & \vdots & & \\ a_{n1} & a_{n2} & \cdots & a_{nn} \end{bmatrix} \qquad - 2.6$$

This matrix is called the <u>technical</u> coefficient matrix because in such a matrix, the technology of production is clearly displayed.

---

1. In section 2.2.3 of this chapter reference is made to certain studies which have found Input-Output predictions to be superior to and more accurate than predictions on the basis of certain other techniques.

The Input-Output model is essentially a model of production in which the principal relationships are determined by technological requirements. Optimizing behaviour on the part of producers and consumers is ruled out in this model by the assumptions of fixed technical coefficients and exogenous final expenditures. In this model, quantity and price are two distinct and separate issues. Each of these issues can be analysed independently and without reference to the other.

We know that the total production of a sector is defined as the sum of the deliveries of the output of that sector to all producing sectors and to final users. Assuming that there are n sectors in an economy the equations describing the distribution of the total output of each industry can be represented as:

$$\begin{aligned} X_1 &= X_{11} + X_{12} \ldots\ldots\ldots\ldots + X_{1n} + F_1 \\ X_2 &= X_{21} + X_{22} \ldots\ldots\ldots\ldots + X_{2n} + F_2 \\ &\vdots \\ X_n &= X_{n1} + X_{n2} \ldots\ldots\ldots\ldots + X_{nn} + F_n \end{aligned} \qquad - 2.7$$

From equation (2.5) if we substitute $a_{ij}X_j$ for the corresponding X_{ij} terms then equations (2.7) can be written as :

$$\begin{aligned} X_1 &= a_{11} X_1 + a_{12} X_2 \ldots\ldots\ldots + a_{1n} X_n + F_1 \\ X_2 &= a_{21} X_1 + a_{22} X_2 \ldots\ldots\ldots + a_{2n} X_n + F_2 \\ &\vdots \\ &= a_{n1} X_1 + a_{n2} X_2 \ldots\ldots\ldots + a_{nn} X_n + F_n \end{aligned} \qquad - 2.8$$

This system of equations can be written in matrix notation as :

$$X = A X + F \qquad - 2.9$$

where

X = nx1 vector of gross output

A = nxn matrix of technical coefficients and

F = nx1 vector of final demand.

Solving equation (2.9) for gross output we get

$$X = (I-A)^{-1} F \quad \text{or} \qquad - 2.10$$

$$X = RF \qquad - 2.11$$

Equation (2.10) describes the relationship between final demand and total production in the Input-Output model. It is used to determine the levels of gross output which are required to meet the demands for a given bill of final goods and also support all the production activities involved in providing these final goods. The elements of the inverse matrix, $R=(I-A)^{-1}$, (known as the Leontief inverse) account for both the direct and indirect input requirements associated with the production of a given vector of final demand. Each R_{ij} measures the total stimulus to the ith gross output when the jth final demand only changes by one unit, where R_{ij} is the i, jth element of the Leontief inverse matrix R.

With the help of equation (2.11) one can also calculate the primary input requirements for production activities. This can be explained by taking the example of labour. If data on employment by sector is available the direct input coefficients for labour can be worked out as :

$$l_i = \frac{L_i}{X_i} \qquad (i = 1,2,\ldots,n) \qquad - 2.12$$

where

L_i = labour employed in sector i (measured in physical units)

X_i = gross output of sector i (measured in value terms) and

l_i = direct labour input coefficient of sector i representing the input of labour per unit of output in sector i.

As in the case of intermediate input coefficients, the primary input coefficients are assumed to be fixed reflecting the assumption of no substitution among inputs in production activities. The requirement of labour can thus be calculated as :

$$L = l' (I - A)^{-1} F \qquad - 2.13$$

where

L = 1xn matrix of total labour requirements associated with the production of final demand specified in F and

l' = 1xn vector of direct labour input coefficients.

The analysis of cost-price relationships in the Input-Output model is based on the assumption of average cost pricing. According to this assumption, the cost of each product or output is determined as a weighted average of all input prices. If the Input-Output table is given in physical units and not in values, then the accounting identity between receipts and costs in the jth industry is represented as:

$$p_j X_j = p_1 X_{1j} + p_2 X_{2j} + \ldots + p_n X_{nj} + p_{vj} V_j \qquad - 2.14$$

where

p_j = price of the output of the jth sector and

p_{vj} = price associated with value added in the jth sector.

Dividing both sides of expression (2.14) by X_j gives :

$$p_j = p_1 a_{1j} + p_2 a_{2j} + \ldots p_n a_{nj} + p_{vj} v_j \qquad - 2.15$$

where

v_j = V_j/X_j, value added generated per unit output in the jth sector.

The first n terms on the right hand side of equation (2.15) indicate the cost of intermediate inputs required in the production of one unit of output of sector j. The term $p_{vj}v_j$ indicates the value added or the returns to primary inputs per unit of output of sector j. Expression (2.15) can be rewritten in matrix notation as :

$$P - A'P = v \quad \text{or}$$

$$[I - A']\, P = v \quad \text{or}$$

$$P = [I - A']^{-1}\, v \qquad - 2.16$$

where

P = nx1 vector of prices of the output of sectors.

v = nx1 vector of value added per unit of sectoral output.

A' = transpose of the technical coefficient matrix.

The P vector can also be computed as:

$$P' = v'[I - A]^{-1} \qquad - 2.17$$

where (') denotes transpose of the corresponding matrix.

Expression (2.17) shows that changes in output prices can

result from changes in the matrix of technical coefficients A or changes in the detailed composition of value added v matrix. In standard Input-Output analysis, the prices of the components of value added are usually treated as exogenous. Given this, it is then possible to evaluate the effect of changes in the elements of A and v matrices on output prices.

In the above we have shown how the standard Input-Output technique can be applied for computing sectoral output levels, sectoral primary input levels and sectoral output prices. It should be noted that the above applications are strictly from the demand perspective. They are based on the traditional demand side Leontief model. They tell us the effect on outputs, primary inputs and output prices that result from changes in the demand of the products of one or more sectors. They do not explain things from the supply angle. In other words they do not explain the effect on the economy when there is a change in one or more sectors supplying inputs. In order to trace the effects from the supply angle the traditional demand side model proves unsuitable. In its place the supply side I-O model developed by Ghosh (1958) needs to be used. Most of the analysis presented in the later chapters is from the demand perspective. The supply side model will be described as it is used in chapter 9.

2.2 STUDIES OF STRUCTURAL CHANGE IN AN INPUT-OUTPUT FRAMEWORK: REVIEW OF THE LITERATURE.

The analysis of structural change in the Input-Output framework was pioneered by Wassily Leontief (1953) in the early 1950s. Using Input-Output tables of the U.S. economy which he had

constructed for the years 1919, 1929 and 1939, Leontief sought to investigate the changes in direct input coefficients of these tables and evaluate the effects of coefficient changes in terms of changes in the levels of intermediate and primary inputs required to produce a given bill of goods for final use. Although this study contained only sixteen producing sectors and did not provide sufficient detail, it set forth the basic methodology for analysing structural change in the Input-Output framework.

As the interest in Input-Output techniques spread, also encouraged by the advent of sophisticated computers, more and more countries became involved in constructing Input-Output tables and employing Input-Output techniques in empirical analysis. Intercountry and intertemporal comparisons of Input-Output tables have been attempted in recent years and techniques of analysis developed, to explore structural change with a view to establishing a meaningful relationship between the overall degree of industrialisation and its pattern.

The basic framework of Input-Output theory as explained in the last section gives the relation:

$$X = (I-A)^{-1} \ F$$

where gross production (X), is the product of technology (A) and final demand (F) at a certain point of time. The basic approach of comparison of stuctures through Input-Output tables is that of "comparative statics" (Samuelson, 1948, pp 8) and is generally confined to Leontief's static model (as explained in the last section) in the Input-Output framework.

Comparisons attempted so far relate to the following aspects

of the Input-Output model.

(a) The overall comparison of the structure of production, chiefly on the basis of the Input-Output technical coefficient matrix, A;

(b) Comparisons of individual Input-Output coefficients;

(c) Overall comparison of direct and indirect effects, based on the Leontief inverse of the A matrix, i.e. $(I-A)^{-1}$.

In this section we have presented a brief resume of the techniques developed for the analysis of structural change by considering a few of the important contributions in the literature and summarising them.

2.2.1 Overall Comparison of the Production Structure.

The analysis based on this type of approach is developed in three directions, mostly pioneered by Chenery and Watanabe (1958).

In this analysis the nature of interdependence of production sectors in the Input-Output model is studied in three aspects:

(a) Types of production sectors in terms of statistics, u and w, as defined below.

(b) The positions of the sectors in the triangular arrangement of the Input-Output matrix and

(c) Types of production in terms of measures which give the average change in technology.

According to Chenery and Watanabe the types of production sectors are identified by the ratio of intermediate inputs to total production:

$$u_j = \frac{\sum_i X_{ij}}{X_j} \quad \text{and} \qquad - 2.18$$

also by the ratio of intermediate demand to total demand:

$$w_i = \frac{\sum_j X_{ij}}{X_i} \qquad - 2.19$$

where X_{ij} is the consumption by the jth sector of goods produced by the ith sector and X_j is the total output of the jth sector. According to the two-way u-w classification an individual production sector can be characterised as "Final Manufacture" (i.e. a sector having high u and low w), "Final Primary Production" (with low u and low w), "Intermediate Manufacture" (with high u and high w) and "Intermediate Primary Production" (with low u and high w). High or low u and w are arrived at depending on whether the values of u and w are above or below their mean values respectively. By an application of this classification to actual Input-Output tables of four countries Chenery and Watanabe (1958), attempted to assess the similarity or otherwise of the overall pattern of production across these countries.

The second approach based on triangularisation of the Input-Output matrix used by Chenery and Watanabe was to find out the existence of one way interdependence such as sequences of raw cotton-textiles-clothing etc. for the four countries. Triangularisation reveals heirarchical pattern of interindustry transactions. For triangularisation the sectors are arranged in

such a way that all entries on one side of the diagonal (say above) of the matrix are zeroes. In this system the sector in the first row gets inputs from all the sectors but does not provide input to any of the producing sectors. On the other hand, the sector in the last row provides inputs to all the sectors but does not get any input from other sectors. Such a sector may be called a primary sector. Rest of the sectors provide inputs to sectors above and get inputs from the sectors below them. In actual practice strict triangularity is difficult to achieve due to the existence of some degree of circularity as found in sequences like coal-steel-coal etc.. In fact with proper arrangement of sectors the structures of Input-Output tables to be compared can be divided into a number of independent blocks such that the entries outside the block are zeroes as far as the sectors corresponding to the block are concerned. Such a structure is called a block diagonal structure.

The third approach as developed by Chenery and Watanabe (1958) attempts to measure the average change in technology. This approach takes two measures-one measure compares two input coefficient matrices taking the sum of absolute difference in all the coefficients in each column and relates this sum to the average total interindustry input of the sector. This ratio termed as "absolute column measure" (Chenery and Watanabe, 1958, pp 498) is defined as:

$$r^{bc} = \frac{\sum_i |a_{ij}^b - a_{ij}^c|}{1/2 \sum_i (a_{ij}^b + a_{ij}^c)} \qquad - 2.20$$

where a_{ij} is the i, j th element in the coefficient matrix and superscripts b and c refer to two countries. The higher the degree of similarity in the structures of production in the two countries the smaller will be the ratio. A similar measure was originally developed by Leontief for single individual coefficients as will be noticed in sequel. If the inputs are completely uncorrelated, the above measure has an upper limit of 2.0 and if the input structures are identical the measure will be zero.

The second measure of the third approach developed by Chenery and Watanabe is as follows:

$$P_{ibc} = \frac{\sum_j |a_{ij}^b X_j^c|}{\sum_j a_{ij}^c X_j^c} \qquad - 2.21$$

In this coefficient the technology of one country was used by Chenery and Watanabe to work out the total intermediate demand of sector i of the other country and the ratio with the actual intermediate demands of that sector for that country. According to Chenery and Watanabe if the structure of both economies for sector i are the same then P_{ibc} should be equal to one. If the value of P_{ibc} is not equal to one then the structures are different.

Chenery and Watanabe (1958) compared the structures of Japan, Norway, Italy and the United States by using the above given three approaches. These measures can also be used for comparing structures over time.

The methodology of Chenery and Watanabe was subsequently adopted by a number of economists for intercountry as well as intertemporal comparisons of structure. In this respect the works of Rasul (1964), Simpson and Tsukui (1965), Manne and Rudra (1965), Carter (1967), Kopcow and Rabinovich (1968), Shishido (1969), Long Jr. (1970), Santhanam and Patil (1972), Gupta (1973), Rudra (1975), Zaidi and Mukhopadhyaya (1975), Bulmer Thomas (1978), Parikh (1978), Guill (1979), Venkatramaiah and Argade (1979), Venkatramaiah, Kulkarni and Argade (1984), Fukui (1986) and Haji (1987) may be referred.

Rasmussen (1956) also suggested a measure for the overall comparison of production structures. Like the Chenery and Watanabe measure (equation 2.20) this measure compares the two technical coefficient matrices column by column to compare the overall input pattern of each industry. Rasmussen used the following weighted index for comparing structures of production for Denmark over two time periods:

$$Q_j = \frac{1}{1/2 \sum_i (X_{ij}^b + X_{ij}^c)} \sum_i \frac{(a_{ij}^b - a_{ij}^c)}{(a_{ij}^b + a_{ij}^c)} (X_{ij}^b + X_{ij}^c) \qquad - 2.22$$

where superscripts b and c refer to two time periods. This measure was subsequently adopted in a study by Zaidi and Mukhopadhyaya (1975).

2.2.2 Comparison of Individual Input Coefficients.

A pioneering comparison of this type was originally applied to the historical data within a single country by Leontief (1953) to study structural change in the American economy using the data

of input coefficients for 1919, 1929 and 1939. He devised an index to show the degree of change in each input coefficient and worked out a weighted frequency distribution of the input coefficients showing different degrees of change. Leontief's relative change index of input coefficients is defined as:

$$\bar{a}_{ij} = \frac{a_{ij}^{b} - a_{ij}^{c}}{1/2\ (a_{ij}^{b} + a_{ij}^{c})} \qquad - 2.23$$

Leontief introduced an appropriate system of weights, to the above measure, to let a change in an important input receive priority over a change in an unimportant input. The weights corresponding to equation (2.23) are

$$\frac{X_{ij}^{b} + X_{ij}^{c}}{2} \qquad - 2.24$$

where the symbols are as defined earlier. a_{ij} is an element of the technical coefficient matrix A, X_{ij} is an element of the transaction matrix and b,c refer to years.

Rasmussen's (1956) study for Denmark adopts the Leontief method for 1947 and 1949 data. The Government of Japan (1957) carried out studies similar to those of Leontief and Rasmussen, for the Japanese economy, for 1951 and 1954. Later on similar work was done by Watanabe (1961) by comparing the individual coefficients for fifteen countries.

Commenting on the above methodology, Hatanaka (1960) notes that neither Leontief nor Rasmussen deal with the relative changes in the row coefficients and points out that "the effects

on input coefficients of quality improvements and price substitution may be discovered with more facility by examining the input coefficients in the same row than by examining the input coefficients in the same column" (1960, pp 70).

The above technique of analysis of coefficient change is applicable to situations where a two point comparison is involved. In situations involving more than two point comparisons, particularly temporal comparisons, the well known classical methods of time series analysis have been tried by Tilanus (1966) for the Netherlands economy, 1948-1961, and by Sevaldson (1970) for the Norwegian economy, 1949-60, to study the temporal changes in individual coefficients by fitting trends by time regression methods.

There are other studies of direct comparisons of individual input ratios at different points in time. Helzner (1954) examined variations in input coefficients in the U.S. steel industry over a nine year period for 'significance' in the sense that a constancy assumption for these coefficients would lead to impermissible errors in gross output estimates. Phillips (1953) found greater inter-firm than temporal variation in selected input coefficients in the U.S. ball and roller bearing industry. Cameron (1952-3), using a very fine industrial classification for Australia, found considerable stability over 5 to 10 year periods in coefficients and concluded that his results on the whole support the Leontief hypothesis of input proportionality in the short run for major material inputs. Cumberland (1952), found definite stability in some input coefficients of critical U.S. defence materials over the period 1945 to 1950, while other

coefficients showed a distinct time trend. Carter (1963) systematically examined the effects of changes in technology on the coefficients of some American industries, relating changes in the flow matrix to investment. Sevaldson (1963) analysed several types of variation for some coefficients in two Norwegian industries. Wittmeyer (1969) compared the chemical industry input structure of several industrially developed countries by studying input coefficients (both quantity and value coefficients) of the chemical industry across these countries. Vaccara (1970) examined the cell by cell coefficients to determine whether or not the input coefficients of a given industry move in the same way as the overall average. She found a very marked degree of variability in the extent and direction of change over time. Arrow and Hoffenberg et al (1959) and Forssell (1972), using regression analysis attempted to separate the causes for changes in Input-Output coefficients. Naganna (1977), in a cross section study using regression analysis, reveals that the extent of inter-mine variations in input coefficients of the coal mining industry in India is very large and concludes that a stable input structure cannot be a compatible proposition for the coal mining industry in India. Khan (1991) analysed the change in Pakistan's interindustry relationships by comparing the qualitative direction of change in the direct input coefficients.

Tilanus' (1966) measurement of temporal change in Input-Output coefficients by the classical statistic, "the coefficient of variance", i.e. the ratio of standard deviation to the mean of the observations, is essentially a modified version of Leontief's

relative change index (equation 2.23), incorporating more than two temporal observations for each cell of the Input-Output coefficient matrix. Another modified version of Leontief's relative change index which combines all the cell level indices into a single measure is due to Augostinovics (1970) and is defined as :

$$\alpha^{bc} (An,m) = \frac{2}{n.m} \sum_{i,j} \frac{| a_{ij}^{b} - a_{ij}^{c} |}{(a_{ij}^{b} + a_{ij}^{c})} \qquad - 2.25$$

where α^{bc} is a measure of change in the matrix An,m between periods b and c. This measure indicates the "average percentage change in the coefficients, without weighting by the size of coefficients or the production level of the user or delivering sectors"(pp 261). The coefficient of variation and Augostinovics' measure of structural change were applied in a study by Venkatramaiah, Kulkarni and Argade (1984).

2.2.3 Overall Comparison in Terms of Inverse Matrices

The sectorwise comparison of structures of different economies or the same economy over time can also be done by comparing the direct as well as indirect requirements of different sectors. Comparisons can also be made with the help of sectorwise backward and forward linkages based on the Leontief inverse matrices.

Watanabe (1964) used the Leontief inverses R, for comparing the sectorwise direct and indirect demands for EEC countries and Japan. Similar work was done later by Khan (1991) for Pakistan. Hazari and Krishnamurthy (1970) and Parikh (1976) used the

inverse matrices to work out sectoral direct and indirect employment created per unit of final demand of different sectors. Yotopoulous and Nugent (1973) and Bulmer-Thomas (1978) used the column sums of the $(I-A)^{-1}$ matrices as a measure of linkages of different sectors. Allauddin (1988) worked out the direct and indirect labour and capital required to sustain a unit change in the final demand of different sectors of Bangladesh.

Rasmussen (1956), also on the basis of the inverse matrices, developed measures of backward and forward linkages for comparing sectorwise structures. According to Rasmussen, the sum of column elements of the inverse matrix (i.e. $\sum_{i=1}^{n} R_{ij}$) gives the total increase in the output of different sectors required to cope with one unit increase in the final demand of sector j. Similarly, the sum of row elements (i.e. $\sum_{j=1}^{n} R_{ij}$) gives the increase in the output of sector i needed to cope with a unit increase in the final demand of all sectors. The following summary measures were compiled by Rasmussen:

$$\text{(i)} \quad U_j = \frac{1}{n} \sum_i R_{ij} \Big/ \frac{1}{n^2} \sum_i \sum_j R_{ij} \qquad - 2.26$$

U_j gives the ratio of the requirements of the output of different sectors corresponding to a unit increase in the final demand of sector j, to the average of the total increase in output needed because of a unit increase in the final demand of all sectors.

$$\text{(ii)} \quad U_i = \frac{1}{n} \sum_j R_{ij} \Big/ \frac{1}{n^2} \sum_i \sum_j R_{ij} \qquad - 2.27$$

U_i gives the ratio of the requirements of sector i's output

corresponding to a unit increase in the final demand of all sectors, to the average requirements of the output of all sectors corresponding to a unit increase in the final demand of all sectors. $U_j > 1$ means that sector j will need large production increases to cope with a unit increase in its final demand than the average of the total increase in output needed because of a unit increase in the final demand of all sectors and vice versa if $U_j < 1$. Similarly $U_i > 1$ means that sector i will have to increase its output more than other sectors for a unit increase in the final demand of each sector and vice versa for $U_i < 1$.

Since U_j and U_i are averages, Rasmussen supplemented them with indices of variation corresponding to U_j and U_i respectively:

$$V_j = \frac{\sqrt{\frac{1}{n-1}\sum_{i=1}^{n}\left(R_{ij} - \frac{1}{n}\sum_{i=1}^{n} R_{ij}\right)^2}}{\frac{1}{n}\sum_{i=1}^{n} R_{ij}} \quad \text{and} \qquad - 2.28$$

$$V_i = \frac{\sqrt{\frac{1}{n-1}\sum_{j=1}^{n}\left(R_{ij} - \frac{1}{n}\sum_{j=1}^{n} R_{ij}\right)^2}}{\frac{1}{n}\sum_{j=1}^{n} R_{ij}} \qquad - 2.29$$

V_j shows the extent to which industry j draws evenly on the system of industries. A relatively high V_j implies that sector j draws one sidedly on the system of industries. On the other hand,

V_i shows to what extent the system of industries draws evenly on industry i. A relatively high V_i implies that the system of industries draws one sidely on sector i.

Rasmussen's index has been used in subsequent studies by Hazari (1970), Diamond (1974), Panchmukhi (1975), Laumas (1975,1976), Karunaratne (1976), Boucher (1976), Venkatramaiah, Kulkarni and Argade (1984), Allauddin (1986), Chowdhury and Kirkpatrick (1987), Haji (1987), Sharma and Ram (1989) and Bhalla and Yue Ma (1990).

On the hypothesis of invariance of technical coefficients, one can project forward or predict backward in time, the gross output level, given the final demand. A comparison of gross output thus obtained with the actuals will show structural change and a comparison with those obtained on alternative models will show the prediction accuracy of the Input-Output model. This approach is due to Leontief (1960) who carried out backward predictions for the years 1919 and 1929 by using 1939 technology matrix and compared the results with the projected Gross National Product (GNP) for the American economy.

Literature on the subject (Hatanaka, 1960), besides the GNP projection approach, which forecasts that the gross output of each industry will change from the base period in the same proportion as the GNP, provides two more bases for appraising the prediction by the Input-Output model. One such is the final demand projection which forecasts that the output of each industry will change from the base period in the same proportion as final demand for that industry. Another is the multiple regression of output on GNP and time which forecasts that the

gross output of each specific industry is linearly related to GNP and time. Arrow and Hoffenberg's study (1959) of the American economy for the same period as that by Leontief but at a more disaggregated level, compares the Input-Output estimates with the above listed models. Other studies giving accounts of similar tests are by Cornfield, Evans and Hoffenberg (1947), Arrow (1951), Chenery, Clark and Cao-Pinna (1953), Barnett (1954), Sevaldson (1956), Shishido (1957), Hatanaka (1960), Matuszewski et al (1964) and Tilanus (1966). Most of these studies found projections on the basis of Input-Output models to be more accurate than projections on the basis of other techniques.

The above studies merely compare the gross output estimates as obtained from the Input-Output model with the actuals to estimate structural change. There are several studies which attempt to factor out the total structural change according to causes of change viz. technological change and final demand change. The methodological framework (called the binary method) in these studies is largely the same. One of the first studies of this kind is by Vaccara and Simon (1968) for the American economy for the period 1947-64, which uses three point Input-Output data for 1947, 1958 and 1964 all valued at the 1958 constant price base and factors out structural change into components in two subperiods 1947-58 and 1958-64. The other studies of a similar type are by Leontief (1953), Rasmussen (1956), Chenery (1960), Chenery, Shishido and Watanabe (1962), Watanabe (1969), Carter (1967,1970,1980), Vaccara (1970), Staglin and Wessels (1972), Armstrong (1974), Venkatramaiah and Argade (1979), Guill (1979),

Venkatramaiah, Kulkarni and Argade (1984), Feldman and Palmer (1985), Urata (1988), Forssell (1988a) and Blair and Wyckoff (1989).

The mathematical formulation to factor out the changes in gross output levels into components, in these studies is of the following type:

$$\begin{aligned} dX &= R_2 F_2 - R_1 F_1 \\ &= (R_2 F_2 - R_2 F_1) + (R_2 F_1 - R_1 F_1) \qquad - 2.30 \end{aligned}$$

where dX denotes the change in output between periods 1 and 2, R denotes the Leontief inverse matrix and F denotes the final demand vector. Subscripts 1 and 2 refer to two time periods.

In this formulation the terminal year technology is taken as fixed and changes in gross production levels is represented as the sum of final demand change weighted by the terminal year's technology and technological change weighted by the initial year's final demand. An equally valid formulation by taking the initial year technology as fixed gives the structural change as the sum of final demand change weighted by the initial year's technology and technological change weighted by the terminal year's final demand viz.

$$\begin{aligned} dX &= R_2 F_2 - R_1 F_1 \\ &= (R_1 F_2 - R_1 F_1) + (R_2 F_2 - R_1 F_2) \qquad - 2.31 \end{aligned}$$

In the next section we will bring out the limitations of all the above measures and also mention the measures we have adopted to meet the objectives of the present study.

2.3 EMPHASIS IN THE PRESENT STUDY.

The measures discussed in the previous section suffer from severe drawbacks as techniques of structural analysis.

The Chenery and Watanabe measures of structural change, discussed in section 2.2.1 suffer from several limitations. Since they are based upon the direct input requirements alone (i.e. upon matrix A), the indirect and secondary repercussions of the input requirements, which may be very significant in many cases, are not included in the estimates. Also they are average measures and do not give the distribution of inputs or deliveries among the various sectors. Further, they are unweighted indices which imply that all industries are of equal importance in an Input-Output table. As a matter of fact, different industries occupy different degrees of importance in bringing about a structural change in an economy.

The second approach (i.e. comparison of individual input coefficients) also suffers from similar drawbacks.

The approach of structural analysis based on inverse matrices is superior to the other two approaches because it can be credited with including direct as well as indirect effects unlike the other two approaches. However, the binary method of structural analysis as used in the literature till date suffers from lack of comprehensiveness. Studies like Carter (1970), Staglin and Wessels (1972), and Forssell (1988a) which use the binary approach, concentrate on the impact of changes in Input-Output coefficients and in final demand on the output of industries at constant prices. Analysis of changes in prices of primary inputs has been given considerably less attention.

However, production for the needs of final demand, the use of primary inputs by industries in terms of constant prices and the role of the cost of using primary inputs in the formation of the cost of production of final demand are each closely related to the other. Forssell (1988b) has recently developed a decomposition technique which makes it possible to do such studies. His approach is an extention of the binary approach. The present study draws heavily on Forssell's model and with some modifications uses it for analysing the structural changes in India. The model will be discussed and explained in detail in parts in the following chapters.

Rasmussen's indices, as explained in section 2.2.3, are very widely used as measures of sectoral backward and forward linkages because they include both direct and indirect effects. But this index suffers from a serious qualitative inconsistency in the evaluation of forward linkages (Jones, 1976). The output approach (or the supply side approach) has been proposed for the evaluation of forward linkages by Jones (1976) to overcome the conceptual drawbacks of Rasmussen's approach. The present study will also use Rasmussen's measures with the modifications suggested by Jones for measuring sectoral linkages in the Indian context. This approach will also be discussed in detail later in chapter 9.

2.4 OBJECTIVES OF THE STUDY.

Discussions of economic development deal with changes in the aggregates of national product or its industrial composition. This is necessary to understand the broad movements of the

economy. But there is more to economic development than just aggregated magnitudes. An economy is a web of numerous activities carried out by the different constituent units like firms, industries, sectors etc. that generate the macro economic magnitudes like national income or consumption. As economic development takes place, that is, there is a sustained change in the economic aggregates, there is usually also a change in the network of activities lying behind the simple aggregates. Leontief (1966) has rightly said - "it is necessary to penetrate below the surface of global statistics and such round terms as 'development' " (pp 41-42). Each economic system - even that of an underdeveloped country has a complicated internal structure. At different levels of economic development, the volume and nature of the activities of the internal structure are also different. So, in order to understand the nature of economic development, to predict the requirements of inputs, to identify key sectors and to facilitate the formulation of national plans for economic development it is important to examine the detailed internal mechanism of the economy within its broad macro-framework. Since the level of national income varies with different levels of development there is a significant relationship between growth and structural changes in an economy. Thus, there is necessity also of finding out whether the direction and extent of structural changes taking place in an economy are favouring rapid economic growth of the economy or not. The present study is, therefore, undertaken with the purpose of analysing the structural changes taking place in the Indian

economy over the period 1968-69 to 1983-84 and finding its relationship with the country's economic growth over the same period. As already mentioned, the Input-Output technique has been used for the same.

The specific objectives of the present study are as follows:

(i) to analyse and measure structural changes in the Indian economy over the period 1968-69 to 1983-84. The selection of this period of fifteen years has been dictated by the availability of data. The Input-Output tables of the Indian economy, which form the main source of data for the purpose of this study, are available in a comparable format for the years 1968-69, 1973-74, 1978-79 and 1983-84[1] only. The parameters that have been used to measure structural changes are output, employment, cost shares and technology. That is, the main objective of this study is to understand the detailed structure of production of the Indian economy over the period 1968-69 to 1983-84 by analysing and measuring changes in sectoral output, employment, costs and technology. The entire period under study has been divided into three subperiods - the first ranging from 1968-69 to 1973-74, the second ranging from 1973-74 to 1978-79 and the third ranging from 1978-79 to 1983-84. The analysis has been

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1. The Central Statistical Organisation (CSO), since 1968-69 is preparing the Input-Output Transactions tables for the Indian economy every five years following a similar approach. At present we have four Input-Output tables of India, prepared by CSO, with reference years as 1968-69, 1973-74, 1978-79 and 1983-84. The 1989-90 I-O table is under way but has not been included in the present study as it is still not complete.

conducted for the three subperiods as well as for the entire period. Further, the structural changes in all the parameters mentioned above have been decomposed into different sources of change. Changes in sectoral output have been decomposed into effects of changes in the level and composition of final demand, and into effects of changes in Input-Output coefficients. Changes in employment are the result of four main effects - effects of change in the level of final demand, of change in the composition of final demand, of change in intermediate output coefficients and the effects of change in employment coefficients. The structural change in employment has been decomposed into these effects. The cost share changes too have been decomposed into effects of change in primary input prices and into effects of change in the use of intermediate and primary inputs. The structural change in technology has been analysed by measuring changes in the Input-Output coefficients for the four different years under study and by measuring the sensitivity of the value of output of an industry to a change in an Input-Output coefficient. Such a test indicates how important a particular Input-Output coefficient is and how it's importance has been changing over the period under study. These issues will be examined with the help of Forssell's (1988b) Input-Output model with some modifications.

(ii) The second main objective of the present study is to relate the economic growth of the Indian economy over the period

1968-69 to 1983-84 with the structural changes taking place in the economy over the same period. The process of structural change in an economy should be such that it is conducive to rapid economic growth of the economy. Since independence, rapid economic growth has been a major objective of planning in India. In fact, the main emphasis in our Five Year Plans has all along been placed on achieving the highest rate of attainable growth. Nehru once remarked that "Production comes first and I am prepared to say that everything we should do be judged from the point of view of production" (quoted in Viet, 1976, pp 200). It was assumed that all other objectives, such as greater employment opportunities and eradication of poverty, would somehow follow from an increase in national income. In other words, increase in the growth of national income has been a primary goal of our national plans and other objectives have been derivative and secondary. In light of the above, the present study aims at finding out whether the relationship between structural changes and economic growth of the Indian economy over the period under study has been significant or not. The findings in this context can prove to be very useful for the planners and policy makers of our country. It can tell them whether the process of structural change has been in the right direction and if not then the findings of this study will help them in altering the course and extent of structural changes to increase the rate of economic growth in the future. The Input-Output technique has been used alongwith the regression technique for this objective.

For measuring structural change backward and forward linkage measures with some modifications (for forward linkages) have been used. In other words, the sectoral backward linkages have been measured using the simple column multiplier and Rasmussen's index applied to the traditional Leontief inverse while the sectoral forward linkages have been measured using the simple row multiplier and Rasmussen's index applied to the output (or supply side) inverse. The backward and forward output linkages have been worked out for the four different years under study (i.e. 1968-69, 1973-74, 1978-79 and 1983-84). Economic growth has been measured as real Gross National Product for the period under study while structural change has been measured by the linkage values. The growth measures have been regressed on to the linkage measures to find out if there has been a significant relationship between the two or not at the national level over the period under study.

Thus the twin objectives of this study are to ascertain the process of structural change in production that has been taking place in the Indian economy between 1968-69 and 1983-84 as comprehensively as possible and to relate it to the economic growth of the country over the same period.

In the following chapter we present the details of the data used for meeting the objectives of the present study.

CHAPTER 3

THE DATA

The basic data for this study is provided by the 1968-69, 1973-74, 1978-79 and 1983-84 Indian Input-Output tables and supplementary data on employment collected from different sources. The first section of this chapter is devoted to a description of the principal characteristics of the Indian Input-Output tables. The second section addresses the issue of the intertemporal comparability of these Input-Output tables. In this section the adjustments made to the Indian Input-Output tables to bring them on a comparable format are discussed. The final section of this chapter describes the sources and characteristics of the supplementary employment data and discusses the adjustments made to these data to make them consistent with the Indian Input-Output tables.

3.1 PRINCIPAL FEATURES OF THE INDIAN INPUT-OUTPUT TABLES.

The 1968-69, 1973-74, 1978-79 and 1983-84 Indian Input-Output tables can be described as open, static, Leontief type tables. The first Input-Output Transactions table (IOTT) consistent with the National Accounts Statistics related to the year 1968-69 and was published in National Accounts Statistics (NAS), January 1978. This table was prepared jointly by the Central Statistical Organisation (CSO) and Planning Commission. Subsequent to its completion, CSO undertook the preparation of the Input-Output Transactions table (IOTT) for 1973-74 on its own

and decided to continue the work relating to the preparation of Input-Output tables on a regular basis and publish them at an interval of five years. Thus, for the present study we have taken four national IOTTS for India relating to the years 1968-69 (CSO, 1978b), 1973-74 (CSO, 1981b), 1978-79 (CSO, 1989b) and 1983-84 (CSO, 1990). These four tables form the main source of data for the purpose of this study.

The basic Input-Output Transactions tables (IOTTS) for the four reference years are in the form of absorption (Commodity x Industry) matrices at current factor cost where the columns represent the group of industries and the rows group of commodities which are the principal products of the corresponding industries. Each row of the matrix shows in the relevant columns, the deliveries of the total output of the commodities to the different industries for intermediate consumption and final use. The entries read down industry columns give the commodity inputs of raw materials and services that have resulted in the outputs of the particular industries. The column entries at the bottom of the tables for the four reference years give the primary inputs in terms of income from use of labour and capital, that is, gross value added (GVA) and net indirect taxes (NIT).

As the four IOTTS under reference are in the form of commodity x industry matrices, the row totals do not tally with the column totals (CSO, 1990). The difference between each column and the corresponding row totals is due to the inclusion of the secondary products particularly in the case of manufacturing industries. This is so because by-products are also manufactured by industries in addition to their main products. Thus, in the

commodity x industry table, while determining the entries in the rows, a by-product of an industry is transferred to the sector (commodity row) whose principal product is the same as the by-product under reference. The columns of the commodity x industry (absorption) tables, however, show the total of principal products and by-products of each industry (CSO,1990). Hence the row totals do not tally with the column totals.

The detailed IOTT (commodity x industry) of 1968-69 was prepared for 230 sectors whereas those of 1973-74, 1978-79 and 1983-84 were prepared for only 115 sectors. These four tables, however, have been published only in an aggregated form at a common 60 sector classification. The sector classification of 1978-79 and 1983-84 which is exactly identical differs slightly from that of 1973-74 and 1968-69. In the aggregated 60 sector classification, sector 44 (i.e. Miscellaneous Manufacturing sector) of 1983-84 and 1978-79 IOTTS includes `aircraft' whereas for earlier IOTTS relating to 1968-69 and 1973-74, `aircraft' is included in Other Transport Equipment, that is, in sector 43 (CSO, 1990). This is because no commercial aircrafts have been manufactured in our country, only their repair service has been undertaken. This activity has, therefore, been merged with the miscellaneous manufacturing activity since 1978-79 so as to keep the total number of sectors as 60.

The final demand in all the four IOTTs under reference has been distinguished under six categories (i) private final consumption expenditure (PFCE), (ii) government final consumption expenditure (GFCE), (iii) gross fixed capital formation (GFCF),

(iv) change in stocks (CIS), (v) exports of goods and services (EXP) and (vi) imports of goods and services (IMP). PFCE represents the consumption of households and non profit institutions. GFCE has been taken as the current consumption expenditure of the government. CIS includes semi finished goods, the part of output being held by sectors producing these outputs and hence these are free of trade, transport margins and net indirect taxes. Exports have been taken as demands of domestic outputs by foreign countries. Imports are taken at c.i.f values and included in final demand as negative entries.

All the entries in the four basic IOTTs are at current factor cost that is, excluding trade and transport charges and net indirect taxes (indirect taxes less subsidies). The Input-Output Transactions tables (IOTTs), to begin with, were prepared at original purchasers price, that is, at the price in which the actual transactions take place. The entries at factor cost were arrived thereafter by removing the components of trade and transport margins and net indirect taxes. These components have been shown in separate rows in the tables. The row of net indirect taxes thus depicts the taxes paid by the industries on intermediate inputs used in the process of production of industry's output. The matrix of net indirect taxes is obtained by adding the individual matrices of import duty, excise duty, export duty, sales tax and other taxes and subtracting the matrix of subsidies.

The above description dealt strictly with the absorption (commodity x industry) matrices of the four reference years. Another matrix which provides the basic information to the Input-

Output system is the make (industry x commodity) matrix. From these basic matrices the commodity x commodity and industry x industry tables under different technology assumptions have been constructed by C.S.O. for three of the four reference years (i.e. for 1973-74, 1978-79 and 1983-84). For preparing the industry x industry and commodity x commodity matrices, the secondary products of manufacturing industries have been transferred to the industries where they are primarily produced. The two alternative assumptions for transferring of outputs of secondary products are (i) industry technology assumption where input structure of a secondary product is considered to be similar to that of the industry where it has been produced and (ii) commodity technology assumption where the input structure of the secondary product of an industry is assumed to be similar to that of the industry where it is primarily produced. In a commodity x commodity table both rows and columns represent the commodity group sectors. If the secondary products of an industry group alongwith the inputs are transferred to the industry group where they are the principal products, the resulting table is a commodity x commodity Input-Output table under the industry technology assumption. Such a 60 sector table of three of the four reference years (i.e. 1973-74, 1978-79 and 1983-84) forms the basic source of data for these three years for the purpose of this study. Thus the analyses presented in the following chapters have been based on the commodity x commodity Input-Output tables (under the industry technology assumption) of 1973-74, 1978-79 and 1983-84. The 1968-69 table, however, used in this study is in the form of

the basic commodity x industry table. From now on whenever the term "Input-Output table" is used in this study, it will be used to refer to a commodity x commodity table under the industry technology assumption for 1973-74, 1978-79 and 1983-84 while for 1968-69 the term will refer to a commodity x industry table. The commodity x commodity table has been preferred to the commodity x industry, industry x commodity or the industry x industry tables as the basic source of data for 1973-74, 1978-79 and 1983-84 because the basic purpose of this study is to analyse the structure of production and the commodity x commodity table best reflects the technology of production both from the demand and supply sides. Also the basic equation of Input-Output theory [i.e. $X = (I-A)^{-1} F$] will hold only in the case of pure tables like the commodity x commodity one.

However, the analysis involving 1968-69 is based on the commodity x industry table of 1968-69. This was the only table prepared and published for 1968-69 and unfortunately we have no other data source available which would enable researchers to convert the commodity x industry table of 1968-69 to a commodity x commodity one. Thus the analysis presented in the following chapters in based on the commodity x commodity Input-Output tables of 1973-74, 1978-79 and 1983-84 but on the commodity x industry table of 1968-69 on account of the data limitations. It can be argued that the Input-Output coefficients derived from a commodity x commodity table are not significantly different from those derived from a commodity x industry table in the case of India. The coefficient matrix, as mentioned earlier, forms the core of the analysis concerning this study. Since the

coefficients derived from the commodity x commodity and the commodity x industry tables are not very different it can be said that the results got from using the absorption matrix of 1968-69 for the purpose of this study would not be very different from the results one would have got if the commodity x commodity table of 1968-69 had been used instead of the commodity x industry one.

Inspite of the above argument it is advisable to compare the results got from using the 1968-69 table with those got from the other three tables with a certain degree of caution.

3.2 COMPARABILITY OF THE 1968-69, 1973-74, 1978-79 AND 1983-84 INPUT-OUTPUT TABLES

Since the principal analyses presented in this study involve comparison of the four Indian Input-Output tables, the overall value of this research depends crucially upon the degree of comparability. In this section we shall discuss the issue of the comparability of the Indian Input-Output tables, identify those factors which tend to reduce the comparability of these tables, and explain the adjustments which were made to these data for the purpose of this study.

Therefore, before the four Input-Output tables were used for analysing growth and structural changes in the Indian economy a number of initial adjustments were made to them such as converting the tables to a constant price base and subjecting them to some amount of aggregation. As already mentioned the four Input-Output tables are at current prices. Therefore the first adjustment made to them was the conversion of the four Input-Output tables to a constant price base. This is necessary because

figures of Input-Output transactions at current prices do not give a correct picture about the growth and structural change of the economy as the increase in the figures of Input-Output transactions at current prices reflects the combined influence of two factors viz., (a) the increase in the production and usage of real goods and services and (b) the rise in prices. If the increase in Input-Output transactions is due to the first factor, it is an indicator of real growth because it implies that more goods and services become available to the economy. If it is due to the second factor, it shows an unreal inflation of interindustry transactions in money terms. Consequently the four Input-Output tables need to be deflated to constant prices to eliminate the effect of change of price level during the period under study.

For the purpose of the present study it was decided to rebase the 1968-69, 1973-74 and 1978-79 Indian Input-Output tables (at current factor prices) to 1983-84 factor prices, that is, bring all the four tables to a common 1983-84 price level. 1983-84 has been chosen as the base price year because this is the most recent year analysed in Input-Output tables for the purpose of this study and also because the necessary price indexes required for the deflation exercises are available for this year.

The price indexes (Economic Intelligence Service, CMIE, 1989) used in these conversions were not consistent with the 60 sector classification of the original published tables of the four years under reference. Hence the second adjustment made to these tables was the aggregation of the producing sectors to 46

sectors (from the original 60 sectors) such that these 46 sectors were consistent with the available price indexes of CMIE. These two aspects of adjustment are discussed in more detail in the following paragraphs.

Table 3.1 gives the details of the 46 sector classification of producing sectors adopted for the purpose of this study and compares it with the original 60 sector classification of C.S.O. of the four tables.

It is clear from Table 3.1 that as far as possible, efforts have been made to stick to the original 60 sector classification of C.S.O. However, mainly due to the nonavailability of price indexes consistent with the 60 sector classification, the number of sectors had to be reduced from 60 sectors to 46 sectors for the purpose of this study.

In the 60 sector classification there are some sectors for which price indexes are incomplete or are just not available. Each sector is made up of several commodities, articles or services. Incomplete price index means that indexes are not available for most of the commodities comprising a sector. Such sectors were merged with a mother sector whose price indexes were available.

For example, sector 18 (i.e. Jute, Hemp, Mesta Textiles and Textile Products) of our study was got by clubbing together sectors 18* (i.e. jute, hemp & mesta textiles) and 19* (i.e. textile products) of C.S.O. This is because the complete price index of sector 19* was not available in the CMIE source.

The other primary and secondary sectors of our study which

Table 3.1

SECTORISATION ADOPTED FOR THIS STUDY (46 x 46)

Sector No. 1	Name of Sector 2	Sector No. in 60 sector classification of C.S.O. 3	Specification of Sector (major categories 4
1.	Food Crops	1*	paddy, wheat, jowar, bajra, maize, gram, pulses, dals, milling of grains.
2.	Cash Crops	2*	sugarcane, gur, groundnut, raw jute, raw cotton, tobacco plantation.
3.	Plantation Crops	3*	tea, coffee, rubber, coconut, copra.
4.	Other Crops	4*	other cereals and their milling, fruits, vegetables, fibres, oilseeds, dyes & tanning materials, drugs & narcotics, condiments & spices, fodder, grass and other misc. food & non food crops.
5.	Animal Husbandry	5*	milk & milk products, meat and meat products, eggs, raw hides & skins etc., animal services, hunting & trapping.
6.	Forestry & Logging	6*	planting, replanting, conservation of forests, felling & cutting of trees, transportion of logs, industrial wood, bamboo etc., gathering of gums,lacs, etc.
7.	Fishing	7*	rearing & catching of fish etc., fish curing.
8.	Coal & Lignite	8*	coal & lignite mining.
9.	Crude Petroleum, Natural Gas	9*	crude petroleum, natural gas.
10.	Iron Ore	10*	iron ore mining.
11.	Other Minerals	11*	mining of manganese, bauxite, copper, lead, zinc, silver, gold etc., and precious and semi-precious stone mining.
12.	Sugar	12*	manufacture & refining of sugar, boora, candy & khandsari.
13.	Food Products Excluding Sugar	13*	hydrogenated oils, edible oils, tea & coffee curing, misc. food products like processing & canning of meat, milk foods, fruits, vegetables, fish etc., manufacture of dairy products, jams, jellies etc., and other food processing activities.
14.	Beverages	14*	distilling, rectifying & blending of liquor etc., mfg. of aerated drinks, syrups, fruit juices etc.
15.	Tobacco Products	15*	tobacco stemming, redrying etc., and manufacture of bidi, cigars, cigarettes etc.
16.	Cotton Textiles	16*	cotton spinning etc., manufacture of cotton textiles in mills,handlooms etc.

Sector No. 1	Name of Sector 2	Sector No. in 60 sector classification of C.S.O. 3	Specification of Sector (major categories 4
17.	Wool, Silk & Synthetic Fibre Textiles	17*	wool cleaning, spinning, weaving etc., dyeing, bleaching & manufacture of woollen blankets, shawls etc., spinning, weaving, finishing etc. of silk & synthetic fibre textiles.
18.	Jute, Hemp & Mesta Textiles and Textile Products	18*, 19*	pressing, baling, spinning, weaving etc. of jute, hemp, mesta fibre and textiles, textile products like coir mats, mattings etc.
19.	Wood and Wood Products	20*, 21*	sawing & planing of wood, manufacture of plywood, wood containers & other wood products, manufacture and repair of furniture and fixture.
20.	Paper and Paper Based Industries	22*, 23*	manufacture of paper, newsprint, board, pulp and other paper products, printing and publishing of newspapers, books, journals etc. and other allied activities.
21.	Leather & Leather Products	24*	tanning, curing & finishing of leather, hides, leather beltings, sheep & goat skins etc., footwear & other leather products.
22.	Rubber & Plastic Products	25*	tyres & tubes, rubber, plastic shoes, hoses, rubber belting, sponge rubber etc., and other rubber products.
23.	Petroleum Products	26*	products of petroleum refineries.
24.	Coal Tar Products	27*	coke and other coal tar products.
25.	Basic Heavy Chemicals	28*, 29*	basic heavy inorganic & organic chemicals.
26.	Fertilizers	30*	inorganic, organic, mixed & other chemicals.
27.	Paints, Varnishes & Lacquers	31*	paints, varnishes, lacquers & dyestuffs, waxes & polishes.
28.	Pesticides, Drugs & Other Chemicals	32*	insecticides etc., drugs & medicines, cosmetic soap & detergent, inedible oils, synthetic resins, resins & plastic materials, dyestuffs and other chemicals n.e.c.
29.	Cement	33*	cement.
30	Non Metallic Mineral Products	34*	structural clay products like bricks etc., glass & glass products, earthern ware & earthern pottery, lime & plaster, other misc. non metallic mineral products.
31.	Iron & Steel Industries & Foundries	35*	iron & steel & ferro-alloys,iron & steel castings & forgings,pipes, plates, wire drawings, tools & others.

Sector No. 1	Name of Sector 2	Sector No. in 60 sector classification of C.S.O. 3	Specification of Sector (major categories 4
32.	Other Basic Metal Industry	36*	melting, refining, rolling etc. of non ferrous basic metals & alloys.
33.	Metal Products Except Machinery & Transport Equipment	37*	barrels & drums, tinbox containers, steel furniture, lanterns, lamps, bolts & nuts, hand tools, spanners, locks, utensils, blades etc., & other metal products.
34.	Agricultural Machinery	38*	tractors & other agricultural machinery, equipments & implements.
35.	Industrial Machinery For Food & Textiles	39*	rice, dal, flour & oil mill machinery, sugar machinery, tea machinery, textile & jute machinery.
36.	Other Machinery	40*	pharmaceutical, chemical, paper, mining & cement machinery, raod rollers, concrete mixers, boilers, diesel engines, internal combustion engines, air conditioners, refrigerators, machine tools, typewriters, computing, accounting machinery, pumps, sewing machines, ball bearings, compressors etc.
37.	Electrical, Electronic Machinery & Appliances	41*	electric motors, transformers, switchgear, cables & wires, dry cell batteries, electric lamps, fans, switch board panel, radio receiver, etc., electronic equipment like T.V. sets, computers, electronic control instruments, other parts & accessories.
38.	Transport Equipment & Misc. Manufacturing	42*, 43*, 44*	making of ships, boats, etc., rail equipment like locomotives, railway coaches etc., motor vehicles like cars,scooters etc.,cycles, cycle rickshaws etc., & other transport equipment, manufacturing industries n.e.c. like watches & clocks, pens, tooth brushes, combs etc. and manufacture of air-crafts & parts.
39.	Construction	45*	construction & maintenance of buildings, aerodromes, roads, railways, ports, harbours, bridges, tunnels, waterways, industrial plants etc., and activities allied to construction.
40.	Electricity, Gas & Water Supply	46*, 47*	generation & transmission of electric energy, manufacture of gas & its distribution, collection, purification & distillation of water.
41.	Railway Transport Services	48*	government railways, private railways, services incidental to this transport.
42.	Other Transport Services & Storage & Warehousing	49*, 50*	buses, tramways, trucks, taxies, rickshaws, shipping transport by boats, ferries etc., & services incidental to these transports, warehousing & cold storage.

Sector No.	Name of Sector	Sector No. in 60 sector classification of C.S.O.	Specification of Sector (major categories
1	2	3	4
44.	Trade, Hotels & Restaurants	52*, 53*	wholesale & retail trade, services rendered by hotels, boarding houses, eating houses, cafes, restaurants, canteens etc.
45.	Banking & Insurance	54*, 55*	R.B.I., other financial companies, industrial development & other financial corporations, post office saving banks, cooperative credit societies, LIC, postal life insurance etc. & non life insurance like fire, marine, accidents etc.
46.	Other Services	56*, 57*, 58*, 59*, 60*	ownership of dwellings, education, scientific & research services, medical & health services, other services like real estate, religious, legal, recreation, domestic, laundry, barbers & beauty shops, cleaning & dyeing & other personal services, sanitary services etc., public administration & defence.

* has been used to differentiate C.S.O's sectorisation from our sectorisation.

were arrived at by aggregating sectors of C.S.O for similar reasons are sectors 19 (i.e. Wood and Wood Products), 20 (i.e. Paper & Paper Based Industries) and 25 (i.e. Basic Heavy Chemicals) of our study.

Sector 38 of our study (i.e. Transport Equipment and Miscellaneous Manufacturing) was got by clubbing sectors 42*, 43* and 44* of C.S.O for a slightly different reason. The reason is that of 'aircraft' being classified differently in 1968-69 and 1973-74 tables as compared to the 1978-79 and 1983-84 tables. In the former two tables 'aircraft' was included in sector 43* (i.e. in the other transport equipment sector) of CSO while in the latter two tables it was included in sector 44* (i.e. in the miscellaneous manufacturing sector) of CSO. Sector 42* (i.e. railway transport equipment) of C.S.O has also been clubbed in sector 38 of our study on account of its separate price index not being available.

CMIE price indexes are available for the primary and secondary sectors but not for the service sectors. Hence price indexes of services and their price deflators were calculated from the value added figures of services published in National Accounts Statistics (CSO, 1975 ; CSO, 1976 ; CSO, 1978a ; CSO, 1981a ; CSO, 1986). The sectorisation of services adopted for our study was thus such that it was consistent with the sector specification used by NAS for providing value added figures of services.

In the 46 sector classification of our study (see Table 3.1), the first 11 sectors represent primary production, the next 29 sectors relate to the secondary sector and the remaining 6

deal with tertiary activities. In the primary sector, 4 categories belong to agriculture, 1 each to animal husbandry, forestry and fishing and the remaining 4 to mining. The secondary sector includes activities like construction and electricity, gas and water supply. Tertiary activities include services like railway transport, other transport and storage & warehousing, communication, trade, hotels & restaurants, banking & insurance and other services. Henceforth sector numbers used in the following chapters will refer to the 46 sector classification that we have adopted for the purpose of this study.

As explained earlier the original C.S.O tables have final demand divided into six categories, viz. private consumption (PFCE), government consumption (GFCE), gross fixed capital formation (GFCF), change in stocks (CIS), exports (EXP) and imports (IMP). However, for the purpose of this study, it was decided to merge GFCF and CIS into one sector, that of gross investment (GI). This was done to enable an analysis of the effects of changes in total gross investment rather that its two sub-categories.

Hence for the purpose of this study, the four Input-Output tables have a 46 sector transaction matrix and a final demand matrix consisting of five categories - PFCE, GFCE, GI, EXP and IMP.

The next step was to deflate the Input-Output tables to a common price basis. As already mentioned, 1983-84 was chosen as the base price year. In practice, price deflation could not be done at a very detailed level, that is, with cell-by-cell deflators. Only row deflators could be developed to deflate the

1968-69, 1973-74 and 1978-79 tables to 1983-84 prices.

CMIE (Economic Intelligence Service, 1989) provides wholesale price indexes for a comprehensive list of commodities. This formed the main source of data for the deflation of the primary and secondary sectors of 1968-69, 1973-74 and 1978-79 tables. Price indexes for services are not given in the CMIE source. For service sectors we, therefore, used the value added figures given in NAS to develop the price deflators.

CMIE gives commodity wise indexes for 1968-69, 1973-74, 1978-79 and 1983-84 (with base 1970-71 = 100) and also the weights of each commodity. The index for each sector of our study was worked out using the weighted mean of the indexes of all commodities falling within that sector. For example the price index for sector 1, that is, Food Crops (calculated as explained above) for 1968-69, 1973-74, 1978-79 and 1983-84 turned out to be 86.8, 140.9, 177.4 and 274.2 respectively (with base 1970-71 = 100). The price deflator for Food Crops for 1968-69 was calculated by dividing the Food Crops index of 1983-84 by that of 1968-69. In the above example we get this deflator as 3.16. This figure was multiplied to all the entries along the Food Crops row of the 1968-69 current price table to convert them to 1983-84 prices. In a similar manner price deflators were calculated for all the primary and secondary (except Construction, and Electricity, Gas & Water Supply) sectors for the three respective years.

As explained earlier price deflators for services were calculated using the gross value added (GVA) figures provided by NAS for service categories. How this was done can be explained by

taking one example say Communication (sector 43). The gross value added figures for Communication for 1973-74 are available both in current and at 1970-71 prices (CSO, 1978a). The 1973-74 price index for Communication was calculated by dividing the GVA of Communication of 1973-74 at current prices by the GVA of the same year at 1970-71 prices. The price indexes for Communication for the other years were worked out in a similar manner. For example these indexes for 1968-69, 1973-74, 1978-79 and 1983-84 worked out to be 84.1, 111.2, 179.1 and 226.8 respectively (with 1970-71 = 100). The price deflator of Communication for say 1968-69 was then got as described earlier by dividing the index for 1983-84 by that of 1968-69. In this example this deflator works out to be 2.7.

Having deflated the interindustry and final demand matrices of all the tables what remained to be deflated was the NIT and the GVA rows. Since no data for this was available the price deflation exercises for these two rows were carried out as follows:

First the deflated entries of the interindustry and final demand quadrants were summed across each row to yield gross output statistics in new base year prices (i.e. 1983-84 prices) for each producing sector. These gross output statistics were then entered as the new column sums of the interindustry and value added quadrants of a particular year[1]. Then the ratio of

1. This was not done for the 1968-69 table as it in a commodity x industry form in which certain row and column totals do not tally. Therefore the current price column totals of 1968-69 were multiplied by corresponding sector's price deflators to get the constant price column totals. For example the current price column total of Food Crops (sector 1) was multiplied by 3.16 (see page 83) to get the column total of Food Crops in 1983-84 prices.

NIT to output (both at current prices) for each table were worked out. Keeping these ratios constant the new NIT figures of each sector (for a particular year) at 1983-84 prices were worked out by multiplying these ratios to the new gross output statistics (at 1983-84 prices) of each sector. Finally the GVA entries at 1983-84 prices for each sector for that particular year were calculated by subtracting all interindustry input costs and NIT, expressed in the new base year prices from the new gross output statistics (also at constant 1983-84 prices). Here it should be mentioned that deflation of the four tables to constant 1983-84 prices may have affected the results of the study to some extent as the available price indexes which were used for the deflation exercises may not be perfect ones. This limitation of the study is, however, beyond our control. Such compromises have to be made in a thesis devoted to empirical study.

Thus the analyses presented in the following chapters is based on the 46 sector constant price tables of 1968-69, 1973-74, 1978-79 and 1983-84 (all at 1983-84 prices) unless otherwise specified.

3.3 EMPLOYMENT DATA

It has been explained in chapter 2 that one of the parameters used to measure structural change in this study is employment. Analysis of employment and changes in it requires data on sectoral employment levels. The labour matrix of order (1x46) describes the sectoral employment levels in terms of the number employed by each sector for the production of that sector's total output. Normally the best way of conducting an

employment analysis should be with the help of a labour flow matrix of the order (46x46) corresponding to the interindustry flow matrix. The construction of a labour flow matrix however requires a big data base which is not available in our country. As a result employment analysis in this study has been restricted to the use of a row vector showing total sectoral employment levels. The main sources of data on sectoral employment levels were CSO (1989a), Indian Labour Statistics (1978) and 1981 Census figures. CSO (1989a) provides employment (in numbers) for 1970-71 and 1980-81 in a sufficiently detailed sectorisation pattern. However the sectorisation of CSO is not consistent with the 46 sector classification of our study. To solve this problem the following exercises were undertaken:

First the employment figures for 1973-74 and 1983-84 were estimated for the CSO sectors using the compound rate formula applied to the 1970-71 and 1980-81 employment figures given by CSO. The CSO sector description gives employment figures for major groups like for example it gives the employment for Rubber, Plastic, Petroleum and Coal Tar Products together as a sector but not separately for the subgroups like Petroleum Products etc. To find the employment levels of the missing subgroups (consistent with our sectorisation) for 1973-74, CSO, ASI (1974) was used. The proportion of employment of a particular subgroup in the total employment of the main group of CSO, ASI (1974) was used to work out the employment levels of that subgroup for 1973-74[1].

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1. This proportion from CSO, ASI (1974) was multiplied to the corresponding estimated employment of the main group of 1973-74 to get employment in numbers for that particular subgroup for 1973-74.

However for 1983-84 these proportions were taken from 1981 Census figures. It may be pointed out here that the employment levels were estimated only for the years 1973-74 and 1983-84. They were not worked out for 1968-69 and 1978-79 as too many approximations would have to be made due to nonavailability of data. Next the sectoral employment levels were divided by the corresponding sector's total output at constant prices to get the labour coefficient matrices for 1973-74 and 1983-84. The labour coefficient of a particular sector describes the number employed per lakh rupees of output in that sector. These labour coefficient matrices will be required in chapter 7 for conducting structural change analysis in employment for India over the period under study.

The following chapter gives an overall comparison of the four Input-Output tables. The tables used are the 46 sector commodity x commodity tables (except the 1968-69 table which is a commodity x industry one) at constant 1983-84 factor prices.

CHAPTER 4

GENERAL COMPARISON OF THE INPUT-OUTPUT TABLES

In this chapter we will study the structural change that has been taking place in the Indian economy over the period 1968-69 to 1983-84 by a general overall comparison of the four national Input-Output tables referring to the years 1968-69, 1973-74, 1978-79 and 1983-84. We shall investigate the overall stability of structural relationships in the Indian economy by direct comparisons of the Input-Output data in this chapter[1]. The analysis presented in this chapter is through highly summarised versions of the four Input-Output tables. Later chapters will analyse the patterns of structural change in greater detail.

4.1 CHANGES IN FINAL DEMAND AND INTERMEDIATE DEMAND

In this section we will investigate the changes in the proportion of the different final demand categories in total output and in total final demand and also changes in the proportion of intermediate demand in domestic output over the periods, 1968-69 to 1973-74, 1973-74 to 1978-79 and 1978-79 to 1983-84.

As explained in the previous chapter the final demand, for the purpose of this study, has been classified into five categories viz., (i) private final consumption expenditure

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1. Chapter 3 of the Input-Output Transactions Table, 1983-84 (CSO, 1990) gives a similar analysis of the Input-Output transactions for 1968-69, 1973-74, 1978-79 and 1983-84. However, this analysis suffers from two drawbacks. It is based on commodity x industry tables and at current prices.

(PFCE), (ii) government final consumption expenditure (GFCE), (iii) gross investment (GI), (iv) exports (EXP) and (v) imports (IMP).

The proportion of imports in total domestic output increased from 4.3 percent in 1968-69 to 5 percent in 1983-84, the rest of 95.7 percent and 95 percent of demand respectively, having been met by domestic output. The corresponding figures for 1973-74 and 1978-79 were 4.0 percent and 4.7 percent, and 96.0 and 95.3 percent respectively. As a proportion of total final demand imports constituted 7 percent of total final demand in 1968-69, 6.7 percent in 1973-74, 8.4 percent in 1978-79 and 8.9 percent in 1983-84. That is, imports have shown a gradual increasing trend as a proportion of total domestic output as well as total final demand. However, the commodity composition of imports in the total supply varies widely in the periods under study. The Agricultural Crops and Manufactured Food items (sectors 1, 2, 3, 4, and 13 of our study) contributed 10.3 percent of the total imports in 1983-84 as against 11.6 percent in 1978-79, 16.1 percent in 1973-74 and 19.3 percent in 1968-69. This reflects a tendency of our country towards achieving self-sufficiency in foodgrains and manufactured food items through agricultural and industrial growth. The contribution of Crude Petroleum and Natural Gas, Petroleum Products and Fertilizers, Chemicals and Chemical Products (sectors 9, 23, 25, 26, 27 and 28) in total imports was about 37 percent in 1983-84 as against the figure of 40.5 percent in 1978-79, 45.6 percent in 1973-74 and 35.7 percent in 1968-69. The share of this category in total imports was particularly high during 1973-74 on account of the fourfold

increase in crude oil prices towards the end of 1973. The share of Iron and Steel Industries, Basic Metal Industries and Machinery (sectors 31, 32, 33, 34, 35, 36 and 37) in the total supply of imports was about 26 percent in 1983-84 as against 23.3 percent in 1978-79, 25.9 percent in 1973-74 and 26.4 percent in 1968-69. The demand of consumer items like Beverages (sector 14), Sugar (12), Tobacco Products (15), Leather and Leather Products (21), and Iron Ore (10) is met almost fully from domestic output and the imports in these cases were negligible in all the four reference years.

As regards exports, the proportion of exports in total domestic output has increased marginally from 2.8 percent in 1968-69 to 3.9 percent in 1983-84. The corresponding figures for 1973-74 and 1978-79 were 2.8 percent and 4.2 percent, respectively. As a proportion of total final demand, exports rose from 4.5 percent of total final demand in 1968-69, to 4.7 percent in 1973-74, to 7.5 percent in 1978-79 and thereafter decreased slightly to 6.9 percent of total final demand in 1983-84. As regards the exports of commodities, the largest contribution in 1983-84 was from Textile Products (sectors 16, 17, and 18) which was 11.4 percent of total exports in 1983-84. The corresponding figures for 1968-69, 1973-74 and 1978-79 were 17.9 percent, 18.6 percent and 13.4 percent respectively. The next largest contribution in 1983-84 was from Transport Equipment and Miscellaneous Manufacturing (sector 38) which accounted for 9.3 percent of total exports in 1983-84. The share of this category in total exports was 7.4 percent in 1968-69, 7.1 percent in 1973-

74 and 6.3 percent in 1978-79. The exports of Crude Petroleum and Natural Gas item (sector 9) rose tremendously from almost negligible in 1968-69, 1973-74, 1978-79 to about 8.6 percent of total exports in 1983-84. The Non-Metallic Mineral Products (sector 30) accounted for 8.4 percent of total exports in 1983-84 as against 9.8 percent in 1978-79 and 0.4 percent both in 1973-74 and 1968-69. All this reflects that the structure of Indian exports is changing in favour of manufactured goods and mineral fuels while traditional exports like textiles and textile products have been showing a declining trend in 1983-84 as compared to 1968-69.

As regards the proportion of the other final demand categories in total output, private final consumption expenditure (PFCE) was of the order of 40 percent of total output in 1983-84 as against 40.0 percent in 1978-79, 42.9 percent in 1973-74 and 46.6 percent in 1968-69. On the other hand, PFCE as a proportion of total final demand was of the order of 76.1 percent in 1968-69, 71.2 percent in 1973-74, 71 percent in 1978-79 and again 71 percent in 1983-84.

On the other hand, government final consumption expenditure (GFCE) constituted about 5.8 percent of total output in 1983-84 as against 5.5 percent in 1978-79, 6.2 percent in 1973-74 and 5.5 percent in 1968-69. As a proportion of total final demand, GFCE constituted 9 percent in 1968-69, 10.3 percent in 1973-74, 9.7 percent in 1978-79 and 10.3 percent in 1983-84.

Gross investment (GI) as proportion of total domestic output constituted 10.6 percent, 12.4 percent, 11.4 percent and 11.6 percent in 1968-69, 1973-74, 1978-79 and 1983-84 respectively. As

against this, GI was 17.3 percent of total final demand in 1968-69 which increased to 20.5 percent in 1973-74, to 20.1 percent in 1978-79 and to 20.7 percent in 1983-84.

All the final demand categories show gradual changes over the period 1968-69 to 1983-84. The only exception is PFCE which shows a sharp decline as a percentage of total output as well as total final demand over the same period.

To measure the extent of development of any country it is very important to study the change in the share of intermediate demand of industries in the total domestic output of the country. In India the intermediate demand of industries rose from 38.7 percent of total domestic output in 1968-69, to 39.7 percent in 1973-74, to 43.6 percent in 1978-79 and to 44 percent in 1983-84 which is a clear indication of the development of our country. On the other hand, from the point of view of product, gross value added (GVA) shows a declining trend from 58.1 percent of total domestic output in 1968-69, to 57 percent, 52.5 percent and 52.4 percent in 1973-74, 1978-79 and 1983-84 respectively.

4.2 DISTRIBUTION OF INPUTS AND OUTPUTS

In this section we will study the changes in the percentage distribution of total output as well as interindustry output and changes in the input structures also over the period 1968-69 to 1983-84.

To get a comparative picture of the output and input structures of total output the 46 x 46 sector Input-Output tables for the years 1968-69, 1973-74, 1978-79 and 1983-84 have been summarised to show only two sectors in the economy viz.,

"commodities"[1] comprising sectors 1 to 40 and "services"[2] comprising sectors 41 to 46. Table 4.1 gives the percentage distribution of total output while Table 4.2 gives the percentage distribution of inputs for the four reference years.

It is evident from Table 4.1 that though there is little structural difference between 1968-69 and 1973-74, some deviation is noticeable in 1978-79 and 1983-84. The commodities utilised 39.5 percent of total commodity output for intermediate consumption in 1983-84 as against 39.4 percent in 1978-79, 37.3 percent in 1973-74 and 35.8 percent in 1968-69. The services utilised 13.7 percent of total service output for intermediate consumption in 1983-84 as against 14.9 percent in 1978-79, 8.8 percent in 1973-74 and 9.2 percent in 1968-69. The intermediate use of commodities in services and services in commodities did not change much in the four periods of study. The total intermediate use of both commodities and services increased considerably between 1968-69 and 1983-84. As the intermediate use increased, the component of final use in the total output correspondingly declined over the period under study. Thus, the share of commodities in final use to total commodity output was 53.2 percent in 1983-84 as against 54.6 percent in 1978-79, 56.8 percent in 1973-74 and 59 percent in 1968-69. The share of services in final use to total output of services was 68.2 percent in 1968-69, 70 percent in 1973-74, 60.8 percent in 1978-79 and 62.5 percent in 1983-84. Thus there was a slight increase in final use of services in 1983-84 as compared to 1978-79.

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1. "Commodities" include both primary and secondary sectors.
2. "Services" includes the tertiary sector.

Table 4.1

PERCENTAGE DISTRIBUTION OF OUTPUT:
AS PER 1968-69,1973-74,1978-79 AND 1983-84 I-O TABLES

Sl. No.	Item	Year	Commo-dities	Services	Inter mediate use (4)+(5)	Final use	Total Output (6)+(7)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1.	Commodities	1968-69	35.8	5.2	41.0	59.0	100
		1973-74	37.3	5.9	43.2	56.8	100
		1978-79	39.4	6.0	45.4	54.6	100
		1983-84	39.5	7.3	46.8	53.2	100
2.	Services	1968-69	22.6	9.2	31.8	68.2	100
		1973-74	21.2	8.8	30.0	70.0	100
		1978-79	24.3	14.9	39.2	60.8	100
		1983-84	23.8	13.7	37.5	62.5	100
3.	Sub Total	1968-69	32.5	6.2	38.7	61.3	100
		1973-74	33.0	6.7	39.7	60.3	100
		1978-79	34.9	8.7	43.6	56.4	100
		1983-84	34.8	9.2	44.0	56.0	100
4.	Net Indirect Taxes	1968-69	38.8	15.2	54.0	46.0	100
		1973-74	47.5	11.7	59.2	40.8	100
		1978-79	49.6	14.4	64.0	36.0	100
		1983-84	47.1	13.3	60.4	39.6	100
5.	Gross Value Added	1968-69	69.0	31.0	100		100
		1973-74	66.1	33.9	100		100
		1978-79	61.1	38.9	100		100
		1983-84	62.0	38.0	100		100

Commodities : Sectors 1 to 40 of 46x46 Table
Services : Sectors 41 to 46 of 46x46 Table

Source : Computed from the Constant Price (46 Sector) Input-Output tables of 1968-69,1973-74,1978-79 & 1983-84.

Further from Table 4.1 we see that the net indirect taxes on both commodities and services used as intermediate inputs in 1983-84 constituted 60.4 percent of the total net indirect taxes while the remaining 39.6 percent was the share of indirect taxes which is incidental on final use. Due to a decline in the net indirect taxes as an input in both commodities and services sectors, the share of net indirect taxes declined in the case of intermediate use from 64 percent in 1978-79 to 60.4 percent in 1983-84 while for the final use it showed the reverse trend. The gross value added used as an input in the commodities sector declined from 69 percent of the total gross value added in 1968-69 to 62 percent in 1983-84. The share of the services sector in the total gross value added was 31 percent in 1968-69 which increased to 38 percent in 1983-84.

Table 4.2 shows the distribution of inputs as a percentage of total output. In 1983-84, 46.3 percent of the total output of commodities constituted GVA, 49.7 percent intermediate inputs and the remaining 4 percent net indirect taxes incidental to intermediate inputs. In the case of services, GVA, net indirect taxes and intermediate inputs formed 66.6 percent, 2.6 percent and 30.8 percent respectively of the total service sector output. The GVA to output ratio declined over the period from 58.3 percent in 1968-69 to 52.4 percent in 1983-84. This was on account of the decline of GVA to output ratios in both the commodities and services sectors of the economy. On the other hand, the intermediate inputs to output ratios accordingly went up. Thus, in the case of the commodities sector, the intermediate input to output ratio increased from 43.6 percent in 1968-69 to

Table 4.2

PERCENTAGE DISTRIBUTION OF INPUTS:
AS PER 1968-69, 1973-74, 1978-79 & 1983-84 I-O TABLES

Sl. No.	Item	Year	Commodities	Services	Sub-Total	Final Use
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1.	Commodities	68-69	36.0	15.5	30.8	69.3
		73-74	37.3	16.2	31.7	66.5
		78-79	39.4	14.1	31.8	65.1
		83-84	39.5	17.1	32.8	63.9
2.	Services	68-69	7.6	9.2	8.0	26.9
		73-74	7.7	8.8	8.0	29.8
		78-79	10.4	14.9	11.7	31.1
		83-84	10.2	13.7	11.2	32.1
3.	Sub Total	68-69	43.6	24.7	38.8	96.2
		73-74	45.0	25.0	39.7	96.3
		78-79	49.8	29.0	43.6	96.2
		83-84	49.7	30.8	44.0	96.0
4.	Net Indirect Taxes	68-69	2.7	3.2	2.9	3.8
		73-74	3.7	2.5	3.4	3.7
		78-79	4.4	3.0	4.0	3.8
		83-84	4.0	2.6	3.6	4.0
5.	Gross Value Added	68-69	53.7	72.1	58.3	
		73-74	51.3	72.5	56.9	
		78-79	45.8	68.0	52.4	
		83-84	46.3	66.6	52.4	
6.	Total Output	68-69	100	100	100	100
		73-74	100	100	100	100
		78-79	100	100	100	100
		83-84	100	100	100	100

Source : Same as Table 4.1

49.7 percent in 1983-84, while in the case of the services sector this ratio also increased from 24.7 percent in 1968-69 to 30.8 percent of total service output in 1983-84.

The share of net indirect taxes (NIT) on intermediate consumption constituted 2.9 percent of the total intermediate output in 1968-69, 3.4 percent in 1973-74, 4 percent in 1978-79 and 3.6 percent in 1983-84 whereas in the case of final demand, the share of NIT was 3.8 percent, 3.7 percent, 3.8 percent and 4 percent in 1969-69, 1973-74, 1978-79 and 1983-84 respectively. Between 1978-79 and 1983-84 the share of NIT in the case of intermediate consumption showed a slight decline whereas in the case of final demand a slight increase was observed during 1978-79 and 1983-84.

Looking into the composition of final use it is observed from Table 4.2 that 63.9 percent of the total final use related to commodities whereas 32.1 percent was due to services in 1983-84. The corresponding figures for 1978-79 were 65.1 percent and 31.1 percent, for 1973-74 they were 66.5 percent and 29.8 percent and for 1968-69 these figures were 69.3 percent and 26.9 percent respectively. These figures show that the final use of commodities as a percent of total final use show a declining trend while the final use of services show an increasing trend over the period under study. The burden of NIT was higher on commodities as compared to services. In 1983-84 NIT was 4 percent of total output of commodities while it was only 2.6 percent in case of services.

Next we will investigate the changes in the demand and

supply of interindustry output. Table 4.3 gives a comparative picture of the first quadrant (interindustry transactions) of the Input-Output tables for the years 1968-69, 1973-74, 1978-79 and 1983-84. For this the four Input-Output tables have been aggregated to three sectors - primary, secondary and tertiary. Consequently, sectors 1 to 11 of the Input-Output tables are considered as belonging to the "primary sector", sectors 12 to 40 as belonging to the "secondary sector" and the remaining 41 to 46 sectors as belonging to the "tertiary sector".

The diagonal elements of the basic interindustry matrix shows the output of goods and services which are produced and consumed by the same sector. From Table 4.3 we see that this was 39.3 percent of the total intermediate input use for the primary sector and 68.4 percent for the secondary sector in 1983-84. The corresponding figures for the years 1968-69, 1973-74 and 1978-79 were 46.1 percent and 70.8 percent, 39.3 percent and 70.1 percent, and 40.2 percent and 72 percent respectively. For the tertiary sector the percent of output which was produced and consumed by the same sector was 36.6 percent of the total intermediate input use of the tertiary sector in 1983-84. The corresponding figures for 1968-69, 1973-74 and 1978-79 were 29 percent, 29.3 percent and 38.1 percent respectively.

In 1983-84, the rest of intermediate use of the primary sector was shared in terms of 53.7 percent in the secondary sector and 7 percent in the tertiary sector. On the other hand, 11 percent of the secondary sector product was used by the primary and 20.6 percent by the tertiary sector in 1983-84. The tertiary sector product was used by the primary and secondary

Table 4.3

INTER-INDUSTRY OUTPUT SUPPLY :
AS PER 1968-69,1973-74,1978-79 & 1983-84 I-O TABLES
(Percentages)

Sl. No.	Sector/Item	Year	Primary	Secondary	Tertiary	Total IIUSE*
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1.	Primary	1968-69	46.1	50.1	3.8	100
		1973-74	39.3	52.7	8.0	100
		1978-79	40.2	53.2	6.6	100
		1983-84	39.3	53.7	7.0	100
2.	Secondary	1968-69	9.1	70.8	20.1	100
		1973-74	11.6	70.1	18.3	100
		1978-79	10.7	72.0	17.3	100
		1983-84	11.0	68.4	20.6	100
3.	Tertiary	1968-69	10.2	60.8	29.0	100
		1973-74	9.5	61.2	29.3	100
		1978-79	10.1	51.8	38.1	100
		1983-84	10.6	52.8	36.6	100
4.	Total Input	1968-69	22.9	61.1	16.0	100
		1973-74	21.1	62.1	16.8	100
		1978-79	18.7	61.4	19.9	100
		1983-84	18.7	60.4	20.9	100
5.	Net Indirect Taxes	1968-69	7.3	64.5	28.2	100
		1973-74	7.4	72.8	19.8	100
		1978-79	6.3	71.3	22.4	100
		1983-84	-6.1	84.0	22.1	100
6.	Gross Value Added	1968-69	50.6	18.3	31.1	100
		1973-74	47.0	19.1	33.9	100
		1978-79	40.1	21.0	38.9	100
		1983-84	38.9	23.0	38.1	100

* IIUSE stands for Intermediate Input Use.
Primary : Sectors 1 to 11 of 46x46 IOTT
Secondary : Sectors 12 to 40 of 46x46 IOTT
Tertiary : Sectors 41 to 46 of 46x46 IOTT

Source : Same as Table 4.1

sectors having shares as 10.6 percent and 52.8 percent of the total intermediate use of the tertiary sector respectively, in 1983-84. Over the period 1968-69 to 1983-84 one can observe a notable decrease in the intermediate use of services in the secondary sector as against an increase in the use of services by the tertiary sector itself. This reflects a greater expansion of the tertiary sector as compared to the secondary sector in the Indian economy which necessitated the diversion of some of the product of the services sector from the secondary to the tertiary sector. The primary sector intermediate use showed a decline in the primary sector itself as against an increase in the secondary and tertiary sectors over the period 1968-69 to 1983-84. There was a slight increase in the use of the secondary sector product by the primary sector over the period 1968-69 to 1983-84 reflecting the mechanisation of the primary sector in the Indian economy over the period under study. The changing structure of the Indian economy in favour of the secondary and tertiary sectors is reflected in the GVA figures which show a decline from 50.6 percent of the total GVA in 1968-69 to 38.9 percent in 1983-84 in the primary sector, an increase from 18.3 percent to 23 percent in the secondary sector over the same period and again an increase from 31.1 percent in 1968-69 to 38.1 percent in 1983-84 in the tertiary sector.

It is clear from Table 4.3 that the burden of net indirect taxes (NIT) falls on the secondary sector which was responsible for 84 percent of the total NIT in 1983-84 showing a tremendous increase from 71.3 percent in 1978-79. The incidence of NIT on

the primary sector was 6.3 percent of the total NIT in 1978-79 which decreased to -6.1 percent in 1983-84. This was mainly due to an increase in the subsidies granted by the government to agriculture in 1983-84.

Table 4.4 depicts the input structure of the primary, secondary and tertiary sectors. The input requirements of the primary sector went up from 23 percent of its total output in 1968-69 to 28.9 percent in 1983-84 mainly due to the increase in the consumption of products of the secondary sector. In 1983-84, the GVA in the primary sector was 71.9 percent of the total output which declined from 76.5 percent in 1968-69. The input requirements of the secondary sector declined slightly over the period 1968-69 to 1983-84 while that of the tertiary sector increased from 24.7 percent in 1968-69 to 30.8 percent in 1983-84 mainly due to the increase in the inputs drawn from the tertiary sector itself. Correspondingly the GVA in the tertiary sector showed a decline from 72.1 percent in 1968-69 to 66.6 percent in 1983-84. It can be seen from Table 4.4 that the input requirement is maximum in the secondary sector while the GVA is maximum in the primary sector. The share of net indirect taxes (NIT) is largest in the secondary sector which constituted 7.2 percent of the total output of this sector in 1983-84. NIT on the primary sector though insignificant declined from 0.9 percent in 1978-79 to -0.8 percent in 1983-84 this being due to an increase in the subsidies granted by the government to agriculture.

Before concluding this section it would be interesting to see the distribution of the final use of the primary, secondary and tertiary sectors among its various components. Table 4.5

Table 4.4

PERCENTAGE DISTRIBUTION OF INPUTS IN DIFFERENT SECTORS: IN THE 1968-69,1973-74,1978-79 & 1983-84 I-O TABLES.

Sl. No.	Sector/Item	Year	Primary	Secondary	Tertiary	Total IIUSE*
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1.	Rrimary	1968-69	17.0	19.6	2.2	14.2
		1973-74	15.8	19.8	4.3	14.3
		1978-79	16.4	15.7	2.7	12.0
		1983-84	16.7	15.6	2.8	12.1
2.	Secondary	1968-69	3.9	32.4	13.3	16.6
		1973-74	5.7	32.1	11.9	17.4
		1978-79	7.2	35.1	11.4	19.8
		1983-84	8.0	34.0	14.2	20.7
3.	Tertiary	1968-69	2.1	13.4	9.2	8.0
		1973-74	2.1	12.9	8.8	8.0
		1978-79	4.0	15.0	14.9	11.7
		1983-84	4.2	14.2	13.8	11.2
4.	Total Input	1968-69	23.0	65.5	24.7	38.8
		1973-74	23.7	64.9	25.0	39.7
		1978-79	27.6	65.8	29.0	43.5
		1983-84	28.9	63.8	30.8	44.0
5.	Net Indirect Taxes	1968-69	0.5	5.0	3.2	2.9
		1973-74	0.7	6.5	2.5	3.4
		1978-79	0.9	7.0	3.0	4.0
		1983-84	-0.8	7.2	2.6	3.6
6.	Gross Value Added	1968-69	76.5	29.5	72.1	58.3
		1973-74	75.6	28.6	72.5	56.9
		1978-79	71.5	27.2	68.0	52.5
		1983-84	71.9	29.0	66.6	52.4
7.	Total Output	1968-69	100	100	100	100
		1973-74	100	100	100	100
		1978-79	100	100	100	100
		1983-84	100	100	100	100

* IIUSE stands for Intermediate Input Use.

Source : Same as Table 4.1

gives such a distribution for the four reference years. The five components of final use are shown in Table 4.5. As regards the supplies from the primary sector, private expenditure (PFCE) category of final demand accounted for almost the entire final use in all the four periods under study. Imports have been considered as negative outputs of the corresponding domestic sectors. In 1983-84, imports of the primary sector were 8.7 percent and exports 4.6 percent of the total final expenditure, both being higher than the corresponding figures of the previous periods under study.

Private expenditure (PFCE) and Gross investment (GI) almost equally constituted most of the final use of the secondary sector. In 1983-84 PFCE was 49.7 percent while GI was 49.9 percent of the total final demand of the secondary sector. The exports of this sector was 8 percent in 1968-69, 8.4 percent in 1973-74. It increased to 12.7 percent in 1978-79 and thereafter declined to 9.9 percent of total final use in 1983-84. Imports on the other hand, formed 12 percent, 10.4 percent, 15.6 percent and 15.3 percent in 1968-69, 1973-74, 1978-79 and 1983-84 respectively. The net exports of the secondary sector showed a decline in 1983-84 as compared to 1978-79.

As regards the tertiary sector, PFCE followed by GFCE constitute most of the final use of the tertiary sector. In 1983-84 PFCE was 69.5 percent while GFCE was 24.2 percent of the total final use of this sector. The share of the different components of the final demand of the tertiary sector do not show much change over the period 1968-69 to 1983-84.

Table 4.5

PERCENTAGE DISTRIBUTION OF FINAL USE OF OUTPUT: IN THE 1968-69,1973-74,1978-79 & 1983-84 I-O TABLES.

Sl. No. Sector	Year	Pvt Consump (PFCE)	Public Consump (GFCE)	Gross Investment (GI)	Exports (EXP)	Imports (IMP)	T.F.D.*
(1) (2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)*
1.Primary	1968-69	104.0	0.6	0.6	2.1	7.3	100
	1973-74	102.5	0.4	3.8	1.8	8.5	100
	1978-79	101.5	0.02	3.1	2.4	7.2	100
	1983-84	100.1	0.1	3.9	4.6	8.7	100
2.Secondary	1968-69	49.1	4.6	50.3	8.0	12.0	100
	1973-74	42.2	6.5	53.3	8.4	10.4	100
	1978-79	47.1	5.7	50.1	12.7	15.6	100
	1983-84	49.7	5.8	49.9	9.9	15.3	100
3.Tertiary	1968-69	67.8	26.2	2.7	3.9	0.6	100
	1973-74	67.6	25.7	3.3	3.9	0.5	100
	1978-79	69.0	23.6	2.3	6.4	1.3	100
	1983-84	69.5	24.2	2.6	5.6	1.9	100
4.Total Input	1968-69	76.1	9.1	17.3	4.5	7.0	100
	1973-74	71.2	10.3	20.5	4.7	6.7	100
	1978-79	71.0	9.7	20.2	7.5	8.4	100
	1983-84	71.0	10.3	20.7	6.9	8.9	100
5.Net Indirect Taxes	1968-69	64.5	7.1	20.4	8.0		100
	1973-74	73.8	3.3	22.2	0.7		100
	1978-79	62.8	8.4	28.2	0.6		100
	1983-84	59.6	8.7	37.9	-6.2		100
6.Total Output	1968-69	75.6	9.0	17.5	4.6	6.7	100
	1973-74	71.3	10.0	20.5	4.6	6.4	100
	1978-79	70.6	9.7	20.5	7.3	8.1	100
	1983-84	70.6	10.2	21.4	6.4	8.6	100

** Stands for Total Final Demand.
* Col(9) = col(4) + col(5) + col(6) + col(7) - col (8)

Source : Same as Table 4.1

A comparison of the analysis presented in this chapter with the figures explained in chapter 1 show that the coverage of the Indian economy in the Input-Output Transactions tables is consistent with the National Accounts Statistics. In other words, both sets of aggregates are comparable. This fact will add to the utility of the present study.

4.3 SUMMARY

This chapter focussed on the overall stability of structural relationships in the Indian economy by a comparison of the Input-Output data as reflected by the 1968-69, 1973-74, 1978-79 and 1983-84 Input-Output tables. The exercises involved an analysis of changes in final demand and intermediate demand and changes in the distribution of inputs and outputs. These exercises were based on highly summarised commodity x commodity Input-Output tables of the four reference years, all at 1983-84 prices.

Changes in the proportion of different final demand categories in total output and in total final demand were investigated. All the final demand categories showed gradual increases as a percent of total final demand and total output over the period 1968-69 to 1983-84. The only exception was PFCE which showed a sharp decline as a percentage of total output as well as total final demand.

Changes in intermediate demand were also investigated. Intermediate demand as a proportion of the total domestic output showed an increasing trend signifying the development of the Indian economy over the period under study.

Changes in the distribution of outputs and inputs were also

analysed. The total intermediate use of both commodities and services as a proportion of total output of these sectors increased considerably between 1968-69 and 1983-84 while the component of final use in the total output for these sectors correspondingly declined over the period under study.

The investigation of the input structure showed that the GVA to output ratio declined between 1968-69 and 1983-84 on account of the decline in the GVA to output ratios in both the commodities and services sectors. On the other hand, the intermediate inputs to output ratios accordingly showed a rising tendency.

To study the changes in the demand and supply of interindustry output the Input-Output tables of the four reference years were aggregated to three sectors - primary, secondary and tertiary sectors. One notable feature of interindustry output supply over the period under study was a significant decrease in the intermediate use of services in the secondary sector as against an increase in the use of services (as a percent of the total interindustry output of the tertiary sector) by the tertiary sector itself. The intermediate use of the primary sector declined in the primary sector itself and showed an increase in the other two sectors, as a percent of the total interindustry output of the primary sector. A slight increase in the use of the secondary sector product by the primary sector (as a percent of the total interindustry output of the secondary sector) was observed. The GVA as a percent of total GVA showed a decline in the primary sector and an increase in the secondary and tertiary sectors reflecting the changing structure

of the Indian economy in favour of the secondary and tertiary sectors. The input requirements of the primary and tertiary sectors showed an increase (as a percent of the total output of these sectors) while the secondary sector input requirements (as a percent of the total output of the secondary sector) declined marginally over the period under study.

Finally the distribution of the final use of the primary, secondary and tertiary sectors among its various components was studied. PFCE category of final demand accounted for almost the entire final use of the primary sector in all the four periods under study. PFCE and GI almost equally constituted most of the final use of the secondary sector. On the other hand, two-thirds of the total final use of the tertiary sector was accounted for by PFCE while GFCE formed one fourth of it in all the four periods under study.

The analysis presented in this chapter showed that the coverage of the Indian economy in the Input-Output Transactions tables is consistent with the National Accounts Statistics. Later chapters will analyse the patterns of structural change in much greater detail.

CHAPTER 5

STRUCTURAL CHANGE : ANALYSIS OF CHANGE IN OUTPUT

The development of the Indian economy has necessitated marked changes in the structure and functioning of internal economic activities. Enormous technological and social changes have also taken place in the process of transformation of our country from an underdeveloped, backward economy before independence to one of the most industrialised countries of the world today. Forty years ago most industries in the Indian economy were related to the agricultural sector. These industries, by nature, relied heavily on primary inputs and, therefore, tended to be relatively self-contained, independent units. Today, many Indian industries have started relying on intermediate inputs produced by other industries for use in their production activities.

Unfortunately, the absence of relevant Input-Output tables limits detailed investigation of structural changes in the Indian economy to the period 1968-69 to 1983-84 only. As mentioned in chapter 2, the choice of the period for the purpose of this study was dictated by the availability of the comparable 1968-69, 1973-74, 1978-79 and 1983-84 Indian Input-Output tables.

In this chapter we shall investigate structural changes in the Indian economy over the period 1968-69 to 1983-84 by analysing changes in the output of producing sectors. This chapter has been divided into five sections. The methodology used

in the analysis is presented in section 5.1. Section 5.2 discusses the structure of and changes in production of the different sectors of the Indian economy. In section 5.3 the sources of growth of output of the different sectors are identified and measured. The contribution of individual final demand categories to output growth are measured and analysed in section 5.4. Finally, section 5.5 presents a summary of this chapter.

5.1 METHODOLOGY

In this chapter we propose to analyse changes in the output structure of the Indian economy over the period 1968-69 to 1983-84 and to decompose any output changes over the same period into different sources. We have used the four I-O tables of the order (46x46) for the years 1968-69, 1973-74, 1978-79 and 1983-84 (all in constant prices of 1983-84) for this purpose. The output structure of any sector is defined as its sectoral share in total output. Any change in the output of an industry is basically due to two factors : (a) change in final demand and (b) change in I-O coefficients (i.e. technology). For identifying and measuring the sources of output growth we have used Forssell's (1988b) technique with some modifications introduced by us.

5.1.1 Sources of Output Growth

The sources of output growth measure the contribution of factors like production structure (I-O relations), average growth of final demand (or level of final demand) and sectoral composition of final demand, to output growth. The principal feature of an analysis of different sources of growth is that the

basic balancing equation of I-O theory is used as a basis for the decomposition of output growth. Further, the contribution of demand factors such as private consumption, government consumption, gross investment, exports and imports to output growth are also analysed and measured.

Within the context of a static, open I-O model changes in sectoral production can be traced to either changes in the technological relationships among sectors or to changes in the level and composition of final demand. By choosing a specific vector of final demand and treating this vector as fixed over time, it is possible to calculate the total output required to produce this vector of final goods with the interindustry relationships which existed at different points in time. Similarly, it is possible to assume that the I-O relationships among industries are fixed over time and calculate the changes in total production associated with observed changes in the levels and composition of final demand.

For separating the components of output growth we use Forssell's (1988b) methodology with some modifications. The methodology is described in detail in the following paragraphs.

The framework for decomposing the increase in output between the initial year and the terminal year in the period to be analysed is given in Table 5.1.

All the variables in the model given in Table 5.1 are measured in constant t year prices. X_o, P_o, G_o, I_o, E_o and M_o are vectors of gross output, private consumption, government consumption, gross investment, exports and imports by industries, respectively, in the initial year o. R_o is the Leontief inverse

Table 5.1

COMPONENTS OF CHANGE IN INDUSTRIAL OUTPUT

Value of output of the initial year $X_o=R_o.[P_o+G_o+I_o+E_o-M_o]$

- 5.1

1.	Increase in output due to average growth of final demand (or changes in the level of final demand.)	(a) $dX(PL)=R_o.(g_P.P_o)$ (b) $dX(GL)=R_o.(g_G.G_o)$ (c) $dX(IL)=R_o.(g_I.I_o)$ (d) $dX(EL)=R_o.(g_E.E_o)$ (e) $-dX(ML)=R_o.(g_M.M_o)$
		- 5.2
2.	Increase in output due to changes in the composition of final demand.	(a) $dX(PC)=R_o.[P_t-(P_o+g_P.P_o)]$ (b) $dX(GC)=R_o.[G_t-(G_o+g_G.G_o)]$ (c) $dX(IC)=R_o.[I_t-(I_o+g_I.I_o)]$ (d) $dX(EC)=R_o.[E_t-(E_o+g_E.E_o)]$ (e) $-dX(MC)=R_o.[M_t-(M_o+g_M.M_o)]$
		- 5.3
3.	Increase in output due to changes in I-O coefficients.	(a) $dX(PT)=[R_t-R_o].P_o$ (b) $dX(GT)=[R_t-R_o].G_o$ (c) $dX(IT)=[R_t-R_o].I_o$ (d) $dX(ET)=[R_t-R_o].E_o$ (e) $-dX(MT)=[R_t-R_o].M_o$
		- 5.4
4.	Increase in output due to interaction of both final demand change and technology change.	(a) $dX(PB)=[R_t-R_o].[P_t-P_o]$ (b) $dX(GB)=[R_t-R_o].[G_t-G_o]$ (c) $dX(IB)=[R_t-R_o].[I_t-I_o]$ (d) $dX(EB)=[R_t-R_o].[E_t-E_o]$ (e) $-dX(MB)=[R_t-R_o].[M_t-M_o]$
		- 5.5

Value of output of the terminal year $X_t=R_t.[P_t+G_t+I_t+E_t-M_t]$

- 5.6

matrix of I-O coefficients in the year o. X_t, P_t, G_t, I_t, E_t, M_t and R_t stand for corresponding matrices of the terminal year t. g_P is the average growth rate of private consumption between the initial and the terminal year. g_P can be calculated as follows :

$$g_P = \frac{\sum_{i=1}^{46} P_{ti} - \sum_{i=1}^{46} P_{oi}}{\sum_{i=1}^{46} P_{oi}} \qquad - 5.7$$

where i refers to sector number. Similarly g_G, g_I, g_E and g_M stand for the average growth rate of government consumption, gross investment, exports and imports, respectively, between the initial year and the terminal year and each can be calculated like g_P as shown above in equation (5.7). dX represents the change in output, while of the two alphabets within brackets the first one refers to the final demand category, which generates the output change and the second one refers to the component into which such change is decomposed. Thus dX(PL) (see equations 5.2) refers to the change in output due to average growth (L) of private consumption category of final demand (P). In the same way dX(GC) (see equations 5.3) for example, refers to the change in output due to change in the composition (C) of government expenditure (G), while dX(IT) (see equations 5.4) refers to that change in output between the initial and terminal year which is due to change in I-O technology (T) and is attributed to gross investment category of final demand (I). Similarly dX(EB) (see equations 5.5) denotes that change in output which is due to the interaction effect of both change in I-O coefficients and changes

in exports category of final demand (B) between the initial and the terminal year and is attributed to exports (E).

Thus changes in industrial output are the rèsult of four different effects : average growth of final demand (or changes in the level of final demand), changes in the composition of final demand, changes in I-O coefficients and interaction of changes in both I-O coefficients and final demand. When these effects are added together we obtain the total difference in output between the initial year and the terminal year.

Forssell's (1988b) original model of output change decomposed the change in output into only three sources, that is, effects of average growth of final demand, effects of change in the composition of final demand and effects of change in I-O coefficients. This he got by taking the terminal year technology as fixed and representing the total change in gross output as the sum of final demand change weighted by the terminal year's technology and technological change weighted by the initial year's final demand (when all variables are measured in t year prices). That is, according to Forssell,

$$dX = R_t.dF + dR.F_o \qquad - 5.8$$

where d stands for change, X is gross output vector, F is total final demand vector, R is the Leontief inverse and subscripts o and t stand for initial year and the terminal year respectively. An equally valid alternative formulation also suggested by Forssell (1988b) takes the initial year technology as fixed and gives the structural change as the sum of final demand change

weighted by the initial year's technology and technological change weighted by the terminal year's final demand, viz. :

$$dX = R_o.dF + dR.F_t \qquad - 5.9$$

In this formulation Forssell measures all variables in o year prices. In each of the above formulations the two components of change together exhaust the total change in gross output levels "only under the particular procedure" (Vaccara, 1968, pp 24) noted above. The two formulations [equations (5.8) and (5.9)] do not give a unique solution of the final demand and technology components on account of a different set of weights being used. Also, in each of the two formulations one component is weighted by initial year values while the other component is weighted by terminal year values which does not make much sense. For example, in equation (5.8), the final demand effect is analysed keeping terminal year technology constant while the technological change is analysed keeping final demand constant at initial year values. This lacks consistency as both effects should be explained with reference to one common base. In the existing literature on structural change using the binary approach, most studies do not confront this problem and use one of the two formulations (for example Staglin and Wessels, 1972, in their study use formulation 5.8). There are some studies (like Vaccara and Simon, 1968) which try to solve this problem by taking an average of the two formulations to measure the final demand and technological change components of total output change. However, their approach involves a double set of tedious calculations and also does not provide a clear indication of the beginning and end-point

positions of an economy which we feel is very necessary in any analysis involving structural changes. We therefore, look at the problem in a different manner in this study. We prefer to use a procedure employing the same year weights for both components as used in equations (5.2) to (5.5) in Table 5.1 above, that is, we decompose the change in gross output by weighting both the technological change and final demand change effects by <u>initial year</u> values. We feel that any change between two periods should be weighted by initial year values as changes are usually measured with respect to original initial year values. The detailed framework described above in Table 5.1 has been based on the following formulation:

$$dX' = R_0.dF + dR.F_0 + dR.dF \qquad - 5.10$$

Our formulation differs from Forssell's formulations in the sense that a third effect called the "interaction of the two preceding components" (Watanabe, 1969, pp 189), emerges which will be interpreted with the other two effects below. According to Venkatramaiah et al, in formulations (5.8) and (5.9) "where the two components together exhausted the total change without explicit appearance of the interaction component, the method of measuring the relative importance of the two factors, that is, from the standpoint of fixed technical coefficients of the initial year or terminal year, does not lead to a unique solution, as the forward and reverse movements of technology, in all likelihood gives different numerical results. This is attributable to the implicit interaction element confounded in

the two main effects" (Venkatramaiah, Kulkarni and Argade, 1984, pp 35). Our formulation (equation 5.10) therefore has two plus points as compared to Forssell's formulations (equations 5.8 and 5.9). Firstly, it was uses uniform (i.e. initial year) weights to measure both components and secondly it explicitly measures the interaction factor. In other words, it gives actual final demand and technological effects whereas Forssell's formulations give slightly overstated or understated values of these effects on account of the interaction element being included implicitly in both effects.

The first component of output growth of our study (equations 5.2 in Table 5.1) measures that output change which is due only to the average growth of the final demand categories between o year and t year keeping technology constant. The effects of average growth on differences in output have five different components : the growth of private consumption, the growth of government consumption, the growth of gross investment, the growth of exports and the growth of imports. The former three represent the average growth of demand in domestic markets while the latter two represent the average growth of demand in foreign markets and the average growth of supply to the domestic economy from abroad, respectively. The first four of these effects have a positive sign. The last effect has a negative sign because imports are a substitute for domestic output as another source of supply. Any growth of imports is evaluated as if it had been a loss to domestic production. If the growth effect of imports is large enough or the initial amount of imported products is greater than output, the total growth effect may even be negative

(Forssell, 1988b).

The effects of average growth are analysed in order to reveal how much output in each industry would have changed if all 46 elements of a particular final demand category were growing at the same growth rate. When growth rates differ between final demand categories (like gross investment, exports, imports etc.), the resulting rates of growth of industrial output also vary. The growth component represents a base for comparison when only a structural change due to different growth rates between different market categories as a whole (ignoring sectoral growth variations within each final demand category) only has been taken into consideration. Guill (1979) explains this component as representing that output change which is due to changes in the level of final demand only. According to him, if a vector of final demand is constructed by distributing the level of final expenditure of year t among the 46 industries according to the industrial composition of final demand in year 0, and the difference between the two calculated, then this difference is called the change in the level of final demand between year o and year t and the output change associated with it is called that change in output which is due to changes in the level of final demand. This concept of Guill (1979) gives results identical to equations 5.2 of Table 5.1.

Changes in the composition of final demand refer to the difference between the actual sectoral final demand element and the sectoral final demand element calculated according to the average growth rate of the related final demand category. Guill

(1979) measures this component by subtracting that vector of final demand of year t which is constructed by distributing total final demand of year t according to the industrial composition of final demand in year o from the actual final demand vector of year t. This concept of Guill (1979) gives results identical to equations 5.3 of Table 5.1. Thus, the second component of output growth (equations 5.3 in Table 5.1) measures that output change which is due to changes in the composition of final demand between the initial and the terminal year keeping technology constant. The effects of changes in the composition of final demand have the same five markets as sources for change as does the average growth effect. Each of these effects may be positive or negative. A positive effect of private consumption shows that there are more sectors in this final demand category which are growing above the average growth rate of this final demand category, whose effects outweigh the effects of below average growth rate sectors of the same category. The same explanation applies for all other final demand categories except imports. A positive effect of imports on output reveals the dominance of below average growth rate sectors over the above average growth rate sectors. The five market developments may be in different directions, in which case the effects of changes in the composition of final demand partly cancel each other out.

The effects of changes in the composition of final demand categories are analysed in order to find out how much deviations of actual growth of sectors from average growth of a particular final demand category have caused structural changes in industrial output. These changes are exogenous to the production

system under examination. Analysis reveals above and below average growth industries, or the formation of new key industries and the decline of old matured industries (Forssell, 1988b, pp 22). The summation of the first two components of output change gives us the total final demand change effect on total change in output assuming that technology remains constant between o year and t year. That is, average growth component tells us what would have happened to industrial output if all final demand elements were growing at the average growth rate whereas the second component explains what actually happened since in actuality all final demand elements do not grow at the average growth rate.

The third component of output change measures the effect of change in technology (equations 5.4 in Table 5.1) only, on output keeping final demand constant. The effects of technical change are distributed among the five final demand categories. Changes in coefficients are weighted by these categories. These weights may be quite different when the structures of final demand categories deviate from each other. The effects of the categories may even have different signs when the coefficients have changed in different directions. The effects of changes usually partly cancel each other out and only the net effect is presented. Decreases in coefficients have a negative effect on output when they are related to the first four categories of final demand including exports. In the case of imports, decreases in coefficients reduce imports and have a positive impact on domestic output (Forssell, 1988b, pp 22).

The effects of technical change on industrial output are

analysed in order to reveal how much output in each industry has changed because the I-O coefficients have not been constant. The state of technology is indicated by the row of the inverse matrix R. Each row of R shows the direct and indirect demand of the product of the industry of this row by other industries which use this product for satisfying their final demand. These effects indicate structural changes in the production system under examination and in this case are considered from the perspective of different product markets (Forssell, 1988b, pp 23).

Here it should be pointed out that though the term 'technical change' has been used above interchangeably with the term 'I-O coefficient change', it is important to remember that changes in I-O coefficients cannot be attributed solely to changes in technology, but may be the result of many factors. Among these factors are changes in the product mix of individual sectors, divergences in actual technical relationships from the basic assumptions of I-O analysis and shifts in relative prices. Unfortunately, it was not possible to disentangle the effects of these factors on changes in I-O coefficients in the Indian tables. Therefore, for the purpose of this study any changes in I-O coefficients have been assumed to reflect technological changes.

The fourth component of output change (equations 5.5 in Table 5.1) measures the differential effect of final demand change due to technological change, on industrial output. This component emerges as a residual when the same year weights (i.e. initial year weights) are used for both the final demand change and the technological change components of total output change as

explained earlier and shows the interaction effect of final demand change and technology change on output change. Alternatively this component can also be interpreted as measuring the differential effect of technological change due to change in final demand, on industrial output (Venkatramaiah et al, 1984). The effects of this interaction factor are also distributed among the five final demand categories. As explained earlier, separating the interaction component from the three main components (equations 5.2, 5.3 and 5.4 in Table 5.1) is important because if this is not done so, then the three main components get either overstated or understated on account of the interaction factor being included implicitly in them.

5.1.2 Contribution Of Different Final Demand Categories To Output Growth.

The following identities are implied in equations (5.2) to (5.5) of Table 5.1

$$
\begin{aligned}
dX(P) &= dX(PL) + dX(PC) + dX(PT) + dX(PB)\\
dX(G) &= dX(GL) + dX(GC) + dX(GT) + dX(GB)\\
dX(I) &= dX(IL) + dX(IC) + dX(IT) + dX(IB)\\
dX(E) &= dX(EL) + dX(EC) + dX(ET) + dX(EB)\\
dX(M) &= dX(ML) + dX(MC) + dX(MT) + dX(MB)
\end{aligned}
\qquad - 5.11
$$

Equations (5.11) measure the contribution of separate demand factors like private consumption (P), government consumption (G), gross investment (I), exports (E) and imports (M) to output growth between the initial and the terminal year. For example, dX(P) measures the total contribution of private consumption change to the output change by summing up the average growth effect, the change in composition of final demand effect, the

change in technology effect and the interaction factor effect attributable to this final demand category. That is, these identities (equations 5.11) will be used to measure the total individual effect of a final demand category on the total output change.

The decomposition technique explained above describes the structural development of a production system. It separates certain components and in this way helps us to understand better what has happened in the economy.

5.2 PRODUCTION STRUCTURE

In this section we examine the structure of Indian output in 1968-69, 1973-74, 1978-79 and 1983-84 while in the next section we decompose the change in Indian production structure into various sources of change. As explained in the previous section, by production structure we mean the percentage share of a sector's output in the total output of the Indian economy. Table 5.2 shows Indian output structure for the four periods under study, together with the corresponding sectoral growth rates.

Over the period 1968-69 to 1983-84 the share of the agricultural sectors (sectors 1, 2, 3, 4) fell drastically from 27.8% of total output to 19.3%. Each of the agriculture sectors, that is, Food Crops (1), Cash Crops (2), Plantation Crops (3) and Other Crops (4) shows a significant fall over the fifteen year period. The share of Animal Husbandry (5), Forestry and Logging (6) and Fishing (7) also show a decline in their shares in total output over the same period. By contrast, Minerals (sectors 8, 10, 11) except Crude Petroleum and Natural Gas (9)

Table 5.2

INDIAN SECTORAL PRODUCTION STRUCTURE (IN 1983-84 PRICES)

Sector No.*	Production Structure (%)				Average Annual Growth Rate of Production (%)			
	68-69	73-74	78-79	83-84	68-69to 73-74	73-74to 78-79	78-79to 83-84	68-69to 83-84
1.	14.7	13.9	11.2	9.9	2.1	1.5	2.4	2.0
2.	3.8	4.1	2.9	2.7	5.1	-1.4	3.5	2.3
3.	1.0	1.3	0.8	0.6	9.6	-3.7	-0.2	1.7
4.	8.3	7.9	6.6	6.1	2.2	2.1	3.6	2.6
5.	6.5	5.3	5.1	5.6	-0.9	5.3	7.1	3.8
6.	2.1	1.2	0.9	1.3	-8.0	1.7	11.1	1.3
7.	0.7	0.7	0.6	0.4	2.4	2.3	0.5	1.7
8.	0.8	0.6	0.7	0.7	-1.8	7.3	6.1	3.8
9.	0.4	0.3	0.3	0.8	-6.1	11.1	26.2	9.6
10.	0.1	0.1	0.1	0.1	10.7	2.0	5.5	6.0
11.	0.2	0.1	0.2	0.2	-0.2	11.0	11.1	7.2
12.	1.0	0.7	1.2	0.9	-4.6	18.8	-0.1	4.3
13.	2.9	3.4	4.0	3.6	6.7	9.0	3.2	6.3
14.	0.5	0.1	0.1	0.2	-21.3	7.3	14.7	-1.1
15.	1.1	0.8	0.6	0.6	-4.0	0.3	5.4	0.5
16.	2.8	2.7	2.9	2.9	2.2	7.8	4.6	4.8
17.	0.4	0.8	1.2	1.7	20.3	15.0	13.4	16.2
18.	1.1	1.1	1.5	1.4	3.7	12.1	4.0	6.5
19.	1.1	0.8	0.8	0.6	-3.9	6.8	0.8	1.1
20.	0.8	0.9	0.9	1.0	7.1	5.4	7.1	6.5
21.	0.6	0.5	0.4	0.4	1.7	1.4	3.8	2.3
22.	0.8	0.8	0.7	0.9	1.9	3.4	9.8	4.9
23.	1.9	1.6	1.5	2.2	0.4	4.5	13.7	6.0
24.	0.2	0.2	0.2	0.2	9.2	2.9	3.4	5.1
25.	0.4	0.5	0.6	0.6	9.1	11.9	2.3	7.7
26.	0.5	0.4	0.6	0.8	-4.7	16.7	12.9	7.9
27.	0.4	0.3	0.3	0.3	-2.9	8.9	3.6	3.1
28.	1.3	1.8	1.9	2.3	11.5	6.7	9.4	9.2
29.	0.3	0.4	0.3	0.4	12.4	1.6	12.5	8.7
30.	1.5	1.2	1.5	0.9	-1.9	10.4	-5.0	0.9
31.	2.1	2.3	2.9	2.5	5.9	10.6	1.9	6.1
32.	0.5	0.3	0.5	0.4	-4.0	14.3	1.1	3.5
33.	1.1	1.4	0.9	1.0	9.2	-3.5	8.4	4.5
34.	0.3	0.3	0.2	0.2	0.7	2.1	4.6	2.5
35.	0.1	0.3	0.2	0.2	30.8	-2.2	7.1	11.1
36.	0.4	1.1	1.1	1.2	25.1	5.8	5.9	11.9
37.	0.6	1.3	1.3	1.5	20.5	4.5	8.4	10.9
38.	1.8	2.9	2.6	2.8	13.7	3.6	6.8	8.0
39.	8.9	7.3	7.7	7.2	-0.7	7.0	3.9	3.3
40.	1.2	1.6	1.9	2.5	8.0	9.8	11.3	9.7
41.	1.5	1.5	1.5	1.4	2.7	6.3	3.9	4.3
42.	3.2	3.2	3.8	4.2	3.6	9.7	6.8	6.7
43.	0.3	0.4	0.4	0.4	5.3	6.4	8.7	6.8
44.	8.8	9.9	12.6	10.0	5.5	11.1	0.4	5.6
45.	1.3	1.6	2.1	2.0	7.6	11.6	4.9	8.0
46.	10.0	10.2	9.6	11.9	3.7	4.7	9.7	6.0
Total	100.0	100.0	100.0	100.0	3.3	5.9	5.1	4.8

* For Sector Specifications see Table 3.1, Chapter 3.

Source : Computed from the (46 Sector) I-O Tables for the years 1968-69,1973-74,1978-79 & 1983-84 (at 1983-84 prices)

had broadly similar shares of output from 1968-69 to 1983-84. On account of the fall in the shares of most sectors comprising the primary sector (sectors 1 to 11), its share fell from 38.6% of total output to 28.4% over the same period. On the other hand, the service sector's (sectors 41 to 46) share rose from 25.1% of the total output to 29.9% from 1968-69 to 1983-84. Of the service sectors, Trade, Hotels and Restaurants (44), Banking and Insurance (45) and Other Services (46) show a significant increase in their shares. These structural changes reflect differences in the primary and service sectors' growth rates. The average annual growth rate of output during 1968-69 to 1983-84 for all the primary sectors except Crude Petroleum and Natural Gas was less than 4% while for most of the service sectors this growth rate was much higher around 6-8%. The only exception in the primary sector category is Crude Petroleum and Natural Gas (9) which showed an average annual growth rate of 9.6% during the fifteen year period under study. This reflects a shift in the sources of energy supplies in India, from coal and lignite to oil and gas during the 1968-69 to 1983-84 period. Thus, over the period under study the growth rate of Coal and Lignite (8) was only 3.8% per annum which was less than half that of the Oil and Gas (9) sector.

The secondary sector (sectors 12 to 40) also showed an increase in its share from 36.3% in 1968-69 to 41.7% of total output in 1983-84. Of all the secondary sectors those which show a very high growth rate over the period under study are Wool, Silk and Synthetic Fibre Textiles (17) with a growth rate of 16.2% annually, Pesticides, Drugs and Other Chemicals (28) with

9.2%, Cement (29) with 8.7%, Machinery for Food and Textile Industries (35) with 11.1%, Other Machinery (36) with 11.9%, Electric, Electronic Machinery (37) with 10.9%, Transport Equipment and Miscellaneous Manufacturing (38) with 8.0% and Electricity, Gas and Water Supply (40) with an average annual growth rate of 9.7% over the 1968-69 to 1983-84 period. These are the sectors which show a relatively high increase in their output shares in 1983-84 as compared to 1968-69. Other secondary sectors with an average annual growth rate around 6-7% over the same period are Food Products excluding Sugar (13), Jute, Hemp, Mesta, Other Textiles (18), Paper and Paper Products (20), Petroleum Products (23), Basic Heavy Chemicals (25), Fertilisers (26) and Iron and Steel Industries and Foundries (31). On the other hand, sectors like Sugar (12), Beverages (14), Tobacco Products (15), Wood and Wood Products (19), Leather and Leather Products (21), Non Metallic Minerals (30), Agricultural Machinery (34) and Construction (39) show a much lower growth rate of 2-3% and also show some decline in their output shares from 1968-69 to 1983-84. Thus among the secondary sectors there is a shift in favour of chemicals, machinery, cement, transport equipment and electricity, gas and water supply sectors. Such a structural shift in production from agriculture to industry, especially to heavy industry and to services usually occurs during the process of economic development because the income elasticity of demand for agricultural products is lower than those for other products. In the Indian case, however, this structural shift seems to have been helped by government policies. Specifically, over the period

1968-69 to 1983-84 the Indian government gave more encouragement to the expansion of heavy industry through investment and other incentives as compared to the agriculture sector.

Thus, changes in the structure of production indicate that the Indian economy diverted from agriculture to heavy and intermediate industrial goods and also towards services. This suggests an intensification of interindustry relationships in the production process.

Table 5.3 shows the percentage share of total output used for intermediate purposes.

Table 5.3

Share of Intermediates in Total Production (in 1983-84 prices)

Year	Share of intermediates in total production(%)
1968-69	38.7
1973-74	39.7
1978-79	43.6
1983-84	44.0

Source : Same as Table 5.2

As explained in chapter 4 also, from Table 5.3 it can clearly be seen that the importance of intermediate production in total production has been increasing continuously from 1968-69 to 1983-84. This measure is a clear indication of the development process of the Indian economy over the period under study.

The agriculture sector shows a continuous decline in its share throughout the period. As can be seen from Table 5.2 the share of the sectors comprising agriculture shows a decline in 1973-74 as compared to 1968-69, then declines again in 1978-79

and further in 1983-84. The shift in the secondary and service sectors (whether positive or negative) is not so uniform in the three subperiods, 1968-69 to 1973-74, 1973-74 to 1978-79 and 1978-79 to 1983-84 and show fluctuations in the different subperiods both in their sectoral shares and sectoral growth rates. Overall, the average annual growth rate of total output was fastest in the period 1973-74 to 1978-79 at 5.9% per annum. During 1968-69 to 1973-74 total output grew at an average rate of 3.3% while over the period 1978-79 to 1983-84 its growth rate was 5.1% per annum. If we look at the period 1968-69 to 1983-84 as a whole, we see that total output grew at an average annual growth rate of 4.8%.

5.3 SOURCES OF OUTPUT GROWTH

The sources of output growth are analysed for the three subperiods 1968-69 to 1973-74, 1973-74 to 1978-79, 1978-79 to 1983-84 as well as for the entire period, that is, from 1968-69 to 1983-84 under study. Breakdowns of the sources of output growth for 1968-69 to 1973-74, 1973-74 to 1978-79 and 1978-79 to 1983-84 are shown in Tables 5.4, 5.5 and 5.6 respectively while Table 5.7 shows the different sources of output growth for the total period 1968-69 to 1983-84. These tables show the actual contribution (in lakh rupees) as well as the percentage contribution (i.e. shares) to changes in output, of changes in the level of final demand, changes in the composition of final demand, changes in I-O coefficients and changes in the interaction (of final demand change and I-O coefficient change) factor. These results are shown for each sector as well as for

the total economy. The percentage figures across each row sum to 100. Expressing the magnitude of each contribution in this way enables us to compare the results across sectors. These tables also show the total increase in the output with reference to the initial year of the period and also how much the output increased due to the effects of each of the four components with reference to the output of the initial year of the period under study. This section begins by analysing the results for the 1968-69 to 1973-74 subperiod and then discusses the results for the other subperiods and for the total period also.

Table 5.4 breaks down output growth for the 1968-69 to 1973-74 subperiod. During these years, when output grew at 3.3% a year (see Table 5.2), the major impetus to growth came from increases in the level of final demand due to which total output increased by 16.7 percent. Contributions from the other factors were substantially smaller. Total output increased by 0.5% due to changes in the composition of final demand, while it increased by 0.9% due to changes in technology over the same period. The contribution of the interaction factor was a negative 0.5% which indicates that the contribution from the other three factors would have been understated by 0.5% of the total initial output of 1968-69 had this factor not been included as a component of output change.

Changes in the level of final demand between 1968-69 to 1973-74 was more significant in its effect on production levels than changes in the composition of final expenditures. In other words, if the distribution of final demand had not changed between 1968-69 to 1973-74 and neither had the interindustry

Table 3.4 : SOURCES OF OUTPUT GROWTH, 1968-69 TO 1973-73 (IN 1983-84 PRICES)

Sector No.*	Output 1968-69	Average Growth of F.D.		Composition of F.D		Technical Change		Interaction Factor		Total Change in Output		Output 1973-74
	(Rs. Lakhs)	Rs. Lakhs	% of Total	Rs. Lakhs	% of Total	Rs. Lakhs	% of Total	Rs. Lakhs	% of Total	Rs. Lakhs	%	(Rs. Lakhs)
1.	2594374	215897.8	75.2	124188.9	43.2	-37701.3	-13.1	-15199.4	-5.3	287185.9	100	2880734
2.	664568.0	64675.8	34.1	-71526.6	-37.7	148932.5	78.5	47651.7	25.1	189733.3	100	851689.5
3.	168517.5	18728.6	19.0	82055.1	83.2	1342.4	1.4	-3555.3	-3.6	98570.8	100	266096.1
4.	1469501	137951.1	82.0	-72938.9	-43.4	101503.0	60.4	1665.5	1.0	168180.7	100	1637719
5.	1147439	107002.9	210.8	-206556	-406.9	33750.1	66.5	15037.8	29.6	-50765.3	-100	1094983
6.	364093.5	98142.3	64.9	-95174.4	-63.0	-125742	-83.2	-28391.4	-18.8	-151165	-100	240022.9
7.	121222.5	12339.5	83.0	-42888.8	-288.4	34226.4	230.1	11196.0	75.3	14872.9	100	136260.8
8.	146496.4	34993.0	128.4	18352.5	67.4	-62892.7	-230.8	-17697.3	-65.0	-27244.5	-100	134017.3
9.	74960.7	13127.8	60.5	-122906	-566.1	89134.0	410.5	-1067.2	-4.9	-21712.2	-100	54609.7
10.	8344.9	2116.2	34.8	2076.2	34.1	1223.3	20.1	669.9	11.0	6085.6	100	13903.4
11.	30778.7	12040.5	369.8	-13741.8	-422.1	1197.9	36.8	-2752.3	-84.5	-3255.8	-100	30465.8
12.	179310.8	17126.0	59.6	-40810.7	-142.0	-9137.7	-31.8	4078.2	14.2	-28744.2	-100	142010.5
13.	515290.7	55170.8	26.9	165755.2	80.8	1534.7	0.8	-17254	-8.4	205206.6	100	712366.3
14.	81242.6	6907.9	12.1	-64654.9	-113.7	1577.7	2.8	-703.7	-1.2	-56873	-100	24458.8
15.	193645.9	16357.5	45.8	-65261.5	-182.8	17638.1	49.4	-4436.5	-12.4	-35702.4	-100	157972.4
16.	497591.5	48513.3	71.2	33448.9	49.1	-12034.8	-17.7	-1781.3	-2.6	68146.1	100	553495.7
17.	63552.9	7253.1	7.4	74555.8	76.3	10822.0	11.1	5030.2	5.2	97661.1	100	160034.7
18.	193091.0	33146.9	83.5	18625.4	46.9	-7697.7	-19.4	-4367.8	-11.0	39706.8	100	231104.9
19.	193489.5	58968.7	162.4	4983.2	13.7	-99520.9	-274.1	-746.4	-2.1	-36315.4	-100	158220.3
20.	138510.7	26860.5	51.8	26772.7	51.7	1618.1	3.1	-3433.8	-6.6	51817.4	100	194932.7
21.	99718.9	12651.8	138.9	-11641.2	-127.8	7673.1	84.2	426.4	4.7	9110.0	100	108645.6
22.	149646.4	29706.9	147.6	10369.8	51.5	-8629.5	-42.9	-11324.1	-56.3	20123.0	100	164205
23.	329833.1	40614.4	588.5	-102240	-1481.6	62540.5	906.3	5986.3	86.8	6900.9	100	336200.2
24.	32824.0	8610.8	56.7	2374.2	15.6	7983.4	52.6	-3783.5	-24.9	15185.0	100	50946.7
25.	65434.6	16364.0	48.6	10631.5	31.6	8873.8	26.4	-2208.0	-6.6	33661.3	100	101041.2
26.	94767.0	8701.3	37.2	14431.2	61.6	-41129	-175.6	-5420.2	-23.2	-23416.6	-100	74322.3
27.	65305.7	13115.0	150.1	4971.1	56.9	-18273.2	-209.1	-8550.1	-97.9	-8737.4	-100	56399.9
28.	220806.4	38300.7	23.6	86342.1	53.2	35797.6	22.0	2015.1	1.2	162455.4	100	380091.1
29.	44329.9	15477.1	47.5	-10087.2	-30.9	27755.5	85.1	-546.8	-1.7	32598.6	100	79405.9
30.	271846.6	85527.1	276.0	-68155.8	-220.0	-37437.4	-120.8	-10920.9	-35.2	-30987.2	-100	247101.0
31.	365839.0	115993.0	80.6	-96567.1	-67.1	79140.8	55.0	45388.7	31.5	143955.4	100	487153.1
32.	85269.9	25416.6	8516.8	82424.6	27619.4	-50386.7	-16884	-57752.8	-19352.3	-298.4	-100	69604.4
33.	191533.2	39399.4	36.6	-29910.1	-27.8	64682.3	60.0	33558.4	31.2	107729.9	100	296738.0
34.	58633.1	24955.2	854.8	-34186.8	-1171.1	12638.4	432.9	-487.5	-16.7	2919.3	100	60829.9
35.	17459.3	6867.3	13.9	17317.2	35.1	19411.9	39.3	5752.1	11.7	49348.4	100	66799.4
36.	77816.5	46888.1	28.5	94411.3	57.3	24467.3	14.9	-1121.9	-0.7	164644.9	100	238399.4
37.	109828.1	34168.8	20.0	104546.4	61.3	33840.3	19.8	-2010.1	-1.2	170545.4	100	278900.9
38.	315595.5	76865.0	26.7	202155.4	70.1	9741.2	3.4	-526.7	-0.2	288235.0	100	600872.6
39.	1564777	528691.1	923.9	-459682	-803.3	-93170.4	-162.8	-33064.4	-57.8	-57226.1	-100	1508501
40.	220013.2	35415.0	32.4	79753.9	73.0	-2803.1	-2.6	-3073.1	-2.8	109292.6	100	323593.5
41.	268110.2	44113.7	127.8	-11158.3	-32.3	6247.2	18.1	-4688.4	-13.6	34514.1	100	306900.2
42.	558847.6	92088.4	85.2	-18170.6	-16.8	34634.9	32.1	-489.8	-0.5	108062.9	100	666962.5
43.	57781.1	8794.8	52.2	16510.0	98.0	-5773.8	-34.3	-2683.1	-15.9	16847.9	100	74728.2
44.	1560558	256896.1	53.9	232837.8	48.8	-18203.6	-3.8	5179.2	1.1	476709.4	100	2043102
45.	227298.4	36555.9	35.6	61314.5	59.8	8558.2	8.3	-3861.2	-3.8	102567.4	100	327957.3
46.	1762039	319829.7	90.2	153930.9	43.4	-100363	-28.3	-18969.5	-5.4	354428.1	100	2111582
Total	17661936	2949327	95.0	86874.3	2.8	157589.1	5.1	-89233.4	-2.9	3104557	100	20736085
Increase in Output Due to		Average Growth of F.D. 2949327/17661936 = 16.7%		Change in Composition of F.D. 86874.3/17661936 = 0.5%		Technical Change 157589.1/17661936 = 0.9%		Interaction Factor -89233.4/17661936 = -0.5%		Total Increase in Output 3104557/17661936 = 17.6%		

* For sector specifications see Table 3.1, Chapter 3

Note : The results shown in this table are only approximations since they are based on the 1968-69 I-O table which is in the commodity x industry form.

Source: Same as Table 3.2

deviated from the final demand calculated according to the average growth rate and the effect of such deviation on the output of different sectors. The sum of these two effects shows the net impact of actual final demand change (assuming that technology is constant) on the output change over the period 1968-69 to 1973-74 under study. The average growth of final demand effect is very high for some sectors (see Table 5.4) for the period 1968-69 to 1973-74 like Animal Husbandry (5), Other Minerals (11), Petroleum Products (23), Non Metallic Minerals except Cement (30), Other Basic Metal Industry (32), Agricultural Machinery (34) and Construction (39). Table 5.4 shows that shifts in the composition of final demand resulted in a significant increase in production of Plantation Crops (3), Coal and Lignite (8), Food Products excluding Sugar (13), Textiles (16,17,18), Paper (20), Rubber and Plastic Products (22), Chemicals and Chemical Products (25, 26, 27, 28), Other Basic Metal Industry (32), Machinery except Agricultural Machinery (35, 36, 37), Transport Equipment and Miscellaneous Manufacturing (38), Electricity, Gas and Water Supply (40) and all Services except Railway and Other Transport Services (43, 44, 45, 46). These sectors were the ones with a greater than average growth rate. Changes in the composition of final demand resulted in a reduction in the production of Cash and Other Crops (2, 4), Animal Husbandry, Forestry and Fishing (5, 6, 7), Crude Petroleum and Natural Gas (9), Minerals (11), Sugar (12), Beverages, Tobacco Products (14, 15), Leather (21), Petroleum Products (23), Cement and Other Non Metallic Minerals (29, 30), Iron and Steel (31), Metal Products (33), Agricultural Machinery (34),

Construction (39) and Railway & Other Transport Services (41, 42).

Effects of technical change between 1968-69 to 1973-74 led to an increase in output by 0.9% of the initial output level of 1968-69. Though changes in I-O coefficients had a relatively modest impact on the requirements of total output, there was wide variation in the effects of these changes on the output requirements of different industries over the same period. The requirements of outputs from industries like Cash Crops (2), Other Crops (4), Animal Husbandry (5), Fishing (7), Oil and Natural Gas (9), Minerals (10, 11), Tobacco Products (15), Leather (21), Petroleum and Coal Tar Products (23, 24), Basic Heavy Chemicals and Chemical Products (25, 28), Cement (29), Iron and Steel (31), Metal Products and Machinery (33, 34, 35, 36, 37), Railway Transport and Other Transport Service (41, 42) and Banking and Insurance (45) increased steadily in the first subperiod under study. On the other hand, changes in I-O relations decreased output between 1968-69 to 1973-74 noticeably in industries like Forestry (6), Coal and Lignite (8), Sugar (12), Cotton and Jute Textiles (16, 18), Wood and Wood Products (19), Rubber and Plastic Products (22), Fertilisers, Paints, Varnishes and Lacquers (26, 27), Non Metallic Minerals (30), Other Basic Metal Industry (32) and Construction (39).

Though the overall effect of the interaction factor on output was only -0.5% of the initial output level, in some sectors it was very significant like Fishing (7), Coal and Lignite (8), Other Minerals (11), Rubber, Plastic and Petroleum

Products (22, 23), Paints etc. (27), Other Basic Metal Industry (32) and Construction (39). In these sectors particularly the contribution of the other three components of change would have been significantly different had this factor not been separated out. Thus, in the period 1968-69 to 1973-74 total output increased by 17.6% . Level of final demand constituted 95% of the total output change while composition of final demand formed 2.8%. 5.1% of the total output change was due to technical change while the remaining -2.9% was due to the interaction factor.

The results shown in Table 5.4 involve comparison of the 1968-69 I-O table which is in a commodity x industry form unlike the 1973-74 I-O table which is in a commodity x commodity form. This factor, plus the limitations associated with the deflation to a constant price base, of the four I-O tables used in this study may have affected the results presented in Table 5.4. These factors should be kept in mind while studying the results of Table 5.4.

The results of the computations of sources of output growth for the second subperiod 1973-74 to 1978-79 are reported in Table 5.5. During this period total output grew at the rate of 5.9% annually which was much higher than the 3.3% level (see Table 5.2) of the 1968-69 to 1973-74 subperiod. During this period, contribution of the level of final demand to output growth was a little higher at 24.8% as compared to the first subperiod. Increase in output due to changes in the composition of final demand and due to changes in I-O coefficients were 2% and 5.6% respectively which were also much higher than the levels of the first subperiod under study. This shows that structural changes

Sector No.*	Output 1973-74	Average Growth of F.D.		Composition of F.D		Technical Change		Interaction Factor		Total Change in Output		Output 1978-79
	(Rs. Lakhs)	Rs. Lakhs	% of Total	Rs. Lakhs	% of Total	Rs. Lakhs	% of Total	Rs. Lakhs	% of Total	Rs. Lakhs	%	(Rs. Lakhs)
1.	2880734	673338.4	303.9	-530735	-239.6	80954.6	36.5	-2003.1	-0.9	221554.7	100	3102284
2.	851689.5	258843.4	433.4	-18492.7	-31.0	-186062	-311.6	-114009	-190.9	-59720.6	-100	791993.1
3.	266096.1	82271.8	178.4	-97727.9	-211.9	-19587.6	-42.5	-11069.1	-24.0	-46112.9	-100	219983.9
4.	1637719	409301.9	230.8	-29904.3	-16.9	-145489	-82.0	-56555.7	-31.9	177351.8	100	1815066
5.	1094983	278581.1	86.1	145378.6	44.9	-55199.4	-17.1	-45042.2	-13.9	323718.1	100	1418691
6.	240022.9	59426.7	274.5	67907.6	313.6	-75180.6	-347.2	-30500.6	-140.9	21652.9	100	261677.6
7.	136260.8	41045.5	248.3	22162.0	134.1	-31058.5	-187.9	-15618.2	-94.5	16530.8	100	152791.9
8.	134017.3	32205.1	57.3	-18594.1	-33.1	35123.1	62.5	7470.4	13.3	56204.4	100	190219.3
9.	54609.7	-72273.0	-191.5	-8133.4	-21.6	96950.0	256.9	21195.7	56.2	37739.2	100	92350.1
10.	13903.4	9579.1	665.7	-5675.5	-394.4	-1877.9	-130.5	-586.7	-40.8	1439.0	100	15342.1
11.	30465.8	-730.3	-3.5	26313.9	125.9	-4401.5	-21.1	-273.2	-1.3	20908.9	100	51373.4
12.	142010.5	38855.5	20.0	86157.7	44.2	45079.9	23.2	23851.0	12.3	193944.1	100	335954.5
13.	712366.3	239520.4	62.2	161506.5	41.9	-10630.1	-2.8	-5365.8	-1.4	385031.0	100	1097397
14.	24458.8	5840.3	56.8	4635.5	45.1	-2.9	-0.0	-194.6	-1.9	10278.3	100	34737.1
15.	157972.4	38219.9	1515.9	-26031.8	-1032.5	-8997.7	-356.9	-669.1	-26.5	2521.3	100	160492.7
16.	553495.7	170498.4	67.6	46094.8	18.3	25937.8	10.3	9515.9	3.8	252047.0	100	805560.8
17.	160034.7	45634.8	28.3	137861.1	85.4	-11068.2	-6.8	-10916.5	-6.8	161511.1	100	321561.9
18.	231104.9	110382.1	61.8	64086.7	35.9	8039.1	4.5	-3785.3	-2.1	178722.6	100	409841.2
19.	158220.3	41932.3	68.1	-18149.9	-29.5	28697.3	46.6	9089.5	14.8	61569.2	100	219790.1
20.	194932.7	43374.6	74.3	44835.1	76.8	-28363.3	-48.6	-1443.1	-2.5	58403.2	100	253341.0
21.	108645.6	56078.5	705.0	-40371.7	-507.5	-6856.6	-86.2	-895.6	-11.2	7954.6	100	116592.9
22.	164205	46020.9	155.5	-14252.9	-48.2	-2456.0	-8.3	285.9	1.0	29597.9	100	193803.0
23.	336200.2	67144.0	81.8	-127519	-155.3	123744.3	150.7	18747.8	22.8	82116.6	100	418316.3
24.	50946.7	10413.0	132.4	-11068.1	-140.7	5755.9	73.2	2766.6	35.2	7867.4	100	58811.9
25.	101041.2	16892.4	22.2	14231.9	18.7	39514.2	51.9	5530.2	7.3	76168.8	100	177211.1
26.	74322.3	5632.0	6.5	-40387.5	-46.8	113683.8	131.8	7354.4	8.5	86282.7	100	160602.2
27.	56399.9	16087.1	53.4	-5057.2	-16.8	13807.4	45.8	5280.6	17.5	30117.9	100	86519.7
28.	380091.1	94549.8	65.1	-39359.8	-27.1	58327.6	40.2	31719.4	21.8	145236.8	100	525333.1
29.	79405.9	18178.3	282.8	1624.3	25.3	-8934.7	-139.0	-4438.9	-69.0	6429.0	100	85835.0
30.	247101.0	55870.2	35.5	86863.5	55.2	13033.3	8.3	1469.7	0.9	157236.6	100	404337.4
31.	487153.1	92001.1	28.7	76610.4	23.9	118827.4	37.0	33434.3	10.4	320873.3	100	808013.1
32.	69604.4	3288.1	5.0	49981.3	75.7	13050.6	19.8	-263.9	-0.4	66056.1	100	135657.8
33.	296738.0	74533.8	152.8	-25162.3	-51.6	-85591.9	-175.5	-12559.7	-25.7	-48780.2	-100	247956.9
34.	60829.9	12609.4	187.4	-6660.7	-99.0	924.6	13.7	-143.7	-2.1	6729.5	100	67557.3
35.	66799.4	16648.7	240.8	-10967.3	-158.6	-8483.7	-122.7	-4112.5	-59.5	-6914.8	-100	59888.3
36.	238399.4	33276.4	42.9	-25252.5	-32.5	58282.7	75.1	11342.6	14.6	77649.1	100	316048.4
37.	278900.9	57062.5	83.9	12920.7	19.0	-1117.3	-1.6	-835.1	-1.2	68030.7	100	346932.2
38.	600872.6	159822.9	135.9	-50417.9	-42.9	5910.8	5.0	2270.8	1.9	117586.6	100	718460.0
39.	1508501	335209.9	55.1	212922.1	35.0	52487.4	8.6	7661.9	1.3	608281.3	100	2116782.0
40.	323593.5	73954.1	38.5	-17089.9	-8.9	105796.0	55.0	29646.7	15.4	192306.9	100	515908.3
41.	306900.2	82655.1	75.1	10909.9	9.9	13879.9	12.6	2612.7	2.4	110057.6	100	416956.3
42.	666962.5	193308.2	49.0	-465.3	-0.1	145037.6	36.7	56847.5	14.4	394728.1	100	1061692
43.	74728.2	17092.4	62.7	-11530.1	-42.3	17488.1	64.2	4190.9	15.4	27241.3	100	101969.7
44.	2043102	566665.5	39.8	410416.6	28.9	364913.9	25.7	80133.8	5.6	1422129	100	3465239
45.	327957.3	80642.0	33.5	30062.2	12.5	106555.6	44.3	23301.1	9.7	240560.9	100	568521.5
46.	2111582	454561.6	83.6	-118125	-21.7	155043.1	28.5	52535.8	9.7	544014.5	100	2655605
Total	20736085	5146046	75.2	416348.3	6.1	1155485	16.9	126973.2	1.9	6844854	100	27581006
Increase in Output Due to		Average Growth of F.D. 5146046/20736085 = 24.8%		Change in Composition of F.D. 416348.3/20736085 = 2.0%		Technical Change 1155485/20736085 = 5.6%		Interaction Factor 126973.2/20736085 = 0.6%		Total Increase in Output 6844854/20736085 = 33.0%		

due to government policies and technical development was faster in this period than in the earlier period. This fact is closely related to the higher growth rate of the economy during 1973-74 to 1978-79. In this period total output increased by 33% while in the period 1968-69 to 1973-74 total output increased by only 17.6%. The increase in output during the second subperiod due to the interaction factor was only 0.6%.

In the period 1973-74 to 1978-79 the average growth effect of two sectors - Oil and Natural Gas (9) and Other Minerals (11) was negative. This was due to a very large negative impact of imports of these products in this subperiod. The average growth effect of all the other sectors was positive during the same period.

Shifts in the composition of final demand in the second subperiod resulted in a decline in the production of traditional Indian industries like Agriculture (1, 2, 3, 4), Mining (8, 9, 10), Wood and Wood Products (19), Leather and Leather Products (21), Rubber, Plastic, Petroleum and Coal Tar Products (22, 23, 24) plus a decline in the production of other industries like Fertilisers, Paints, Varnishes and Other Chemicals (26, 27, 28), Metal Products and Machinery except Electric and Electronic Machinery (33, 34, 35, 36), Transport Equipment and Miscellaneous Manufacturing (38), Electricity, Gas and Water Supply (40), Communication (43) and Other Services (46). On the other hand, industries which showed positive effects of changes in the composition of final demand over the same period were Animal Husbandry, Forestry and Fishing (5, 6, 7), Other Minerals (11),

Food Manufacture (12, 13), Beverages (14), Textiles (16, 17, 18), Paper (20), Basic Heavy Chemicals (25), Cement and Other Non Metallic Minerals (29, 30), Iron and Steel and Other Basic Metal Industry (31, 32), Electric, Electronic Machinery (37), Construction (39), Railway Transport Service (41), Trade, Hotels, Restaurants (44) and Banking and Insurance (45). These industries grew in importance during this period.

Technical development increased the demand of the outputs of industries such as Coal and Lignite (8), Oil and Gas (9), Sugar (12), Wood (19), Petroleum and Coal Tar Products (23, 24), Chemicals and Chemical Products (25, 26, 27, 28), Iron and Steel and Other Basic Metal Industry (31, 32), Other Machinery (36), Transport Equipment, Construction and Electricity, Gas, Water Supply (38, 39, 40) and all Services. On the other hand, changes in I-O relations over the same period 1973-74 to 1978-79 decreased output sizeably in industries like Agriculture (2, 3, 4), Animal Husbandry, Forestry and Fishing (5, 6, 7), Mining of Iron Ore and Other Minerals (10, 11), Tobacco Products (15), Paper (20), Leather (21), Rubber and Plastic Products (22), Cement (29), Metal Products (33) and Machinery for Food and Textile Industries (35).

Thus in the second subperiod 1973-74 to 1978-79, of the total change in output the contributions of level of final demand, composition of final demand, technical change and interaction factor were 75.2%, 6.1%, 16.9% and 1.9% respectively. If we compare these figures with those of 1968-69 to 1973-74 period, we see that the share of level of final demand has declined while the shares of composition of final demand and

technical change in total output change have increased considerably.

Table 5.6 gives the results of the computations of output growth for the third subperiod 1978-79 to 1983-84 under study. During this period total output grew at the rate of 5.1% annually (see Table 5.2) which was much higher than the level of the first subperiod but a little lower than that of the second subperiod. During this period total output increased by 27.4% due to changes in the level of final demand. This was higher than the corresponding level of the previous subperiod. On the other hand, the increase in output due to changes in the composition of final demand and due to changes in I-O coefficients were 0.5% and 0.7% respectively which were almost identical to the corresponding levels of the first subperiod but much lower than those of the second subperiod. The contribution of the interaction factor to output growth during the period 1978-79 to 1983-84 was almost negligible that is, -0.1% of the initial output of this period. All this reflects the difference in the growth rates of the Indian economy during the three subperiods under study. During the third subperiod 1978-79 to 1983-84, total output increased by 28.5% which was higher than the 17.6% level of the first subperiod but lower than the 33% level of the second subperiod. This indicates a slowing down of the growth rate in the third subperiod as compared to the second subperiod.

The results of the above aggregate analysis can be explained by a sectoral analysis of the sources of output growth. In the period 1978-79 to 1983-84, we see from Table 5.6 that the average

Sector No.*	Output 1978-79 (Rs. Lakhs)	Average Growth of F.D. Rs. Lakhs	Average Growth of F.D. % of Total	Composition of F.D Rs. Lakhs	Composition of F.D % of Total	Technical Change Rs. Lakhs	Technical Change % of Total	Interaction Factor Rs. Lakhs	Interaction Factor % of Total	Total Change in Output Rs. Lakhs	Total Change in Output %	Output 1983-84 (Rs. Lakhs)
1.	3102284	853570.7	218.7	-411195	-105.4	-44257.8	-11.3	-7839.1	-2.0	390278.0	100	3492562
2.	791993.1	214180.0	143.4	-89614.2	-60.0	21415.5	14.3	3387.1	2.3	149368.4	100	941355
3.	219983.9	56180.1	2753.2	-27206.7	-1333.3	-22604.4	-1107.8	-8409.5	-412.1	-2040.5	-100	217943
4.	1815066	490134.2	141.4	-205466	-59.3	58171.3	16.8	3856.6	1.1	346695.2	100	2161761
5.	1418691	386974.6	66.7	144850.8	25.0	42142.5	7.3	6470.9	1.1	580438.8	100	1999126
6.	261677.6	72440.5	39.8	92892.0	51.0	19461.7	10.7	-2652.2	-1.5	182142.1	100	443821
7.	152791.9	41680.4	1134.1	-23563.2	-641.2	-12354.8	-336.2	-2087.3	-56.8	3675.1	100	156467
8.	190219.3	51526.9	78.2	963.4	1.5	11366.1	17.3	1994.2	3.0	65850.6	100	256073
9.	92350.1	-2549.0	-1.3	242567.2	119.0	-13316.1	-6.5	-22941.0	-11.2	203761.1	100	296113
10.	15342.1	2956.3	62.9	1774.4	37.7	104.7	2.2	-133.6	-2.8	4701.8	100	20044
11.	51373.4	11737.8	33.1	-7734.7	-21.8	27320.3	77.0	4169.5	11.7	35492.9	100	86867
12.	335954.5	91293.6	10094	-45721.8	-5055.4	-37255.6	-4119.3	-9220.5	-1019.5	-904.4	-100	335049
13.	1097397	279856.2	151.1	-69052.7	-37.3	-14720.7	-7.9	-10861.9	-5.9	185220.8	100	1282617
14.	34737.1	9665.7	28.3	24487.8	71.6	183.6	0.5	-130.0	-0.4	34207.1	100	68944
15.	160492.7	43010.8	88.9	-9861.0	-20.4	12278.9	25.4	2933.9	6.1	48362.6	100	208854
16.	805560.8	218481.1	106.5	-28218.6	-13.8	-1353.6	-0.7	16156.9	7.9	205065.7	100	1010630
17.	321561.9	87249.4	30.9	86577.8	30.7	69766.2	24.7	38349.2	13.6	281942.6	100	603504
18.	409841.2	99589.3	111.8	-40186.8	-45.1	22830.9	25.6	6813.8	7.7	89047.2	100	498889
19.	219790.1	63045.9	692.5	-31918.4	-350.6	-13899.6	-152.7	-8123.0	-89.2	9104.7	100	228896
20.	253341.0	68442.9	66.2	32957.1	31.9	5660.8	5.5	-3595.5	-3.5	103465.2	100	356809
21.	116592.9	26041.0	109.4	-11778.7	-49.5	7835.1	32.9	1697.9	7.1	23795.2	100	140386
22.	193803.0	52992.5	46.2	103726.7	90.4	-33370.1	-29.1	-8554.1	-7.5	114794.9	100	308598
23.	418316.3	106461.4	28.3	144419.2	38.3	89463.6	23.7	36418.8	9.7	376763.0	100	795078
24.	58811.9	16824.9	156.7	7795.1	72.6	-11002.1	-102.5	-2882.4	-26.8	10735.4	100	69548
25.	177211.1	41940.5	192.2	40043.6	183.5	-36540.9	-167.5	-23621.3	-108.2	21821.8	100	199032
26.	160602.2	38326.1	28.6	-13217.1	-9.9	95341.1	71.1	13657.0	10.2	134106.9	100	294707
27.	86519.7	24003.7	144.8	2997.1	18.1	-7343.5	-44.3	-3076.4	-18.6	16581.0	100	103101
28.	525333.1	139088.2	46.8	300646.0	101.1	-97902.4	-32.9	-44475.0	-15.0	297356.8	100	822691
29.	85835.0	25260.3	36.8	-1025.9	-1.5	37723.1	55.0	6667.8	9.7	68625.3	100	154461
30.	404337.4	99730.4	109.5	-41515.4	-45.6	-122824	-134.8	-26498.2	-29.1	-91108.2	-100	313229
31.	808013.1	214452.7	273.4	-76023.1	-96.9	-32098.8	-40.9	-27889.2	-35.6	78441.5	100	886462
32.	135657.8	30860.2	419.6	-8156.7	-110.9	-12114.7	-164.7	-3233.7	-44.0	7355.1	100	143016
33.	247956.8	65767.5	53.2	31789.0	25.7	23198.4	18.8	2851.9	2.3	123606.7	100	371564
34.	67557.3	19954.6	116.3	-25489.2	-148.5	20589.5	120.0	2104.4	12.3	17159.3	100	84715
35.	59888.3	16608.6	68.1	2805.3	11.5	3801.3	15.6	1158.5	4.8	24374.0	100	84262
36.	316048.4	81763.0	78.5	106243.3	102.0	-62289.3	-59.8	-21591.4	-20.7	104125.5	100	420177
37.	346932.2	98402.2	57.1	30909.6	17.9	31778.7	18.5	11109.7	6.5	172200.3	100	519134
38.	718460.0	197574.0	71.2	-19965.6	-7.2	75356.7	27.1	24626.0	8.9	277591.0	100	996054
39.	2116782	650157.3	146.4	-238653.0	-53.8	25429.0	5.7	7020.0	1.6	443953.0	100	2560738
40.	515908.3	142738.8	38.9	37843.8	10.3	147426.5	40.2	38987.9	10.6	366997.1	100	882907
41.	416956.3	114531.6	129.1	-43152.6	-48.6	14299.5	16.1	3041.2	3.4	88719.7	100	505678
42.	1061692	282077.1	68.5	53429.6	13.0	58793.3	14.3	17406.8	4.2	411706.9	100	1473401
43.	101969.7	29267.9	55.2	12871.8	24.3	9527.6	18.0	1315.6	2.5	52982.8	100	154953
44.	3465239	938396.1	1445.2	-475860	-732.9	-306173	-471.5	-91432.1	-140.8	64930.6	100	3530174
45.	568521.5	156848.2	102.1	-58541.1	-38.1	47508.8	30.9	7856.0	5.1	153671.9	100	722196
46.	2655605	799918.9	50.9	626776.6	39.9	106920.6	6.8	36880.1	2.3	1570496	100	4226102
Total	27581006	7549455	96.2	126247.1	1.6	204272.4	2.6	-32316.0	-0.4	7847659	100	35428688
Increase in Output Due to		Average Growth of F.D. 7549455/27581006 = 27.4%		Change in Composition of F.D. 126247.1/27581006 = 0.5%		Technical Change 204272.4/27581006 = 0.7%		Interaction Factor -32316/27581006 = -0.1%		Total Increase in Output 7847659/27581006 = 28.5%		

growth effect of Crude Petroleum and Natural Gas (sector 9) on change in output was negative just like its effect in the previous period 1973-74 to 1978-79. While this effect was -72273 lakh rupees in the period 1973-74 to 1978-79 it was much lower at -2549 lakh rupees in the later period. This negative impact was on account of imports of oil and natural gas exceeding its domestic supply. The hike in the oil prices by OPEC in 1973 and in 1980 was the main factor responsible for this.

Shifts in the composition of final demand in the period 1978-79 to 1983-84 resulted in an increase in the production of industries like Animal Husbandry and Forestry (5, 6), Oil and Gas (9), Iron Ore (10), Beverages (14), Wool, Silk, Synthetic Fibre Textiles (17), Paper (20), Rubber, Plastic, Petroleum and Coal Tar Products (22, 23, 24), Basic Heavy Chemicals, Paints, Varnishes, Lacquers and Other Chemicals (25, 27, 28), Metal Products excluding Machinery (33), Machinery except Agricultural Machinery (35, 36, 37), Electricity, Gas and Water Supply (40), Communication (43) and Other Services (46). On the other hand, industries which showed negative effects of changes in the composition of final demand over the same period are Agriculture (1, 2, 3, 4), Fishing (7), Other Minerals (11), Food Products (12, 13), Tobacco Products (15), Cotton, Jute, Hemp and Other Textiles (16, 18), Wood (19), Leather (21), Fertilisers (26), Non Metallic Minerals (30), Iron and Steel and Other Basic Metal Industry (31, 32), Agricultural Machinery (34), Construction (39), Railway Transport Service (41), Trade, Hotels, Restaurants (44) and Banking and Insurance (45). In general, broad trends witnessed in the second subperiod in the effects of final demand

change on production levels are seen to be continuing in the third subperiod also. Thus, there is a decline in the production of traditional industries like agriculture, wood, leather, fertilisers and agricultural machinery. On the other hand, animal husbandry, oil and gas, textiles, paper, chemicals, machinery except agricultural machinery and services like communication emerged as important sectors in the second and third subperiods from the same point of view. As compared to 1973-74 to 1978-79, during 1978-79 to 1983-84 we notice a shift in the textiles sector towards synthetic fibre, wool and silk textiles and a shift towards oil and gas as compared to coal and lignite in the energy sector. Rubber, plastic, petroleum and coal tar products also seem to have come up in the latter period as compared to the former. All this reflects changing consumer needs and changing government policies. Evidence of this is provided by the shift in final expenditures in favour of animal husbandry, oil and gas, paper, chemicals and machinery and against the products of agriculture, wood, leather and industries related to agriculture.

Technical development during 1978-79 to 1983-84 increased the demand of the outputs of industries such as Cash Crops (2), Other Crops (4), Animal Husbandry (5), Forestry (6), Coal and Lignite (8), Other Minerals (11), Tobacco Products (15), Textiles except Cotton Textiles (17, 18), Paper (20), Leather (21), Petroleum Products (23), Fertilisers (26), Cement (29), Metal Products and Machinery (33, 34, 35, 37), Transport Equipment (38), Construction (39), Electricity, Gas and Water Supply (40) and Services (41, 42, 43, 45, 46). On the other hand, changes in

I-O relations over the same period decreased output in industries like Agriculture (1, 3), Fishing (7), Oil and Gas (9), Food Products (12, 13), Wood (19), Rubber, Plastic and Coal Tar Products (22, 24), Chemicals except Fertilisers (25, 27, 28), Non Metallic Minerals (30), Iron, Steel and Other Basic Metal Industry (31, 32), Other Machinery (36) and Trade, Hotels and Restaurants (44). Overall, it can be seen from Table 5.6 that technical change contributed only 2.6% of the total output change during 1978-79 to 1983-84 which was much lower than the corresponding level of 1973-74 to 1978-79. The contributions of level of final demand, composition of final demand and interaction factor in the total output change were 96.2%, 1.6% and -0.4% respectively. The contribution of composition of final demand was also much higher in the second subperiod as compared to the third. This explains that structural change was faster during the second subperiod as compared to the third subperiod.

Having analysed the structural changes in output for the three subperiods separately we shall conclude this section by a brief look at the sources of output growth for the entire period 1968-69 to 1983-84.

Table 5.7 gives the results of the sources of output growth for the total period 1968-69 to 1983-84. During this period total output increased by 100.8% at the rate of 4.8% annually (see Table 5.2). Due to changes in the level of final demand, total output increased by 85.1% while the increase in output due to changes in the composition of final demand, changes in I-O coefficients and the interaction effect were 5.9%, 7.4% and 2.4% of the initial output level of 1968-69, respectively.

	(Rs. Lakhs)	Rs. Lakhs	% of Total	Rs. Lakhs	% of Total	Rs. Lakhs	% of Total	Rs. Lakhs	% of Total	Rs. Lakhs	%	(Rs. Lakhs)
1.	2594374	1799635	200.2	-876076	-97.4	-20322.8	-2.3	-4217.5	-0.5	899018.7	100	3492562
2.	664568	503041.8	180.1	-263511	-94.3	-15066.0	-5.4	54916.4	19.7	279381.1	100	941355
3.	168517.5	138083.9	273.9	-10357.3	-20.5	-25368.5	-50.3	-51940.6	-103.0	50417.3	100	217943
4.	1469501	1108502	160.1	-384359	-55.5	-7724.9	-1.1	-24190.1	-3.5	692227.7	100	2161761
5.	1147439	851660.3	99.8	-15357.9	-1.8	17452.8	2.0	-363.6	-0.0	853391.6	100	1999126
6.	364093.5	389953.8	740.9	41734.0	79.3	-186584	-354.5	-192474	-365.7	52629.3	100	443821
7.	121222.5	105732.6	301.4	-79783.2	-227.4	4545.9	13.0	4583.6	13.1	35078.8	100	156467
8.	146496.4	148849.6	157.0	19506.1	20.6	-24498.4	-25.8	-49046.8	-51.7	94810.4	100	256073
9.	74960.7	-33537.4	-15.3	13110.8	6.0	132629.7	60.3	107585.0	48.9	219788.0	100	296113
10.	8344.9	11435.1	93.5	804.5	6.6	-65.7	-0.5	52.6	0.4	12226.4	100	20044
11.	30778.7	32532.8	61.2	-2906.0	-5.5	11843.1	22.3	11676.0	22.0	53146.0	100	86867
12.	179310.8	128606.8	78.3	13156.6	8.0	3375.6	2.1	19156.4	11.7	164295.4	100	335049
13.	515290.7	438255.2	56.5	446736.0	57.6	-24903.8	-3.2	-84628.8	-10.9	775458.5	100	1282617
14.	81242.6	58192.9	469.8	-73193	-590.9	2156.7	17.4	455.9	3.7	-12387.6	-100	68944
15.	193645.9	139001.2	915.6	-144544	-952.1	19990.0	131.7	735.2	4.8	15181.5	100	208854
16.	497591.5	377209.2	71.8	116119.3	22.1	8619.6	1.6	23310.7	4.4	525258.8	100	1010630
17.	63552.9	51586.9	9.5	369660.5	68.3	24359.7	4.5	95507.8	17.7	541114.9	100	603504
18.	193091.0	235246.9	76.5	56469.3	18.4	12035.2	3.9	3725.2	1.2	307476.6	100	498889
19.	193489.5	210803.4	613.5	-28330.3	-82.5	-75690.1	-220.3	-72424.4	-210.8	34358.5	100	228896
20.	138510.7	121433.4	56.8	154942.5	72.5	-17239.7	-8.1	-45450.3	-21.3	213685.8	100	356809
21.	99718.9	103588.3	253.5	-73656.4	-180.3	7829.3	19.2	3098.7	7.6	40859.8	100	140386
22.	149646.4	131487.8	79.9	124463.0	75.7	-31102.0	-18.9	-60332.9	-36.7	164515.8	100	308598
23.	329833.1	251259.8	53.9	-186715	-40.1	232359.6	49.9	168876.5	36.3	465780.5	100	795078
24.	32824.0	33611.7	99.5	373.8	1.1	8498.8	25.2	-8696.5	-25.7	33787.7	100	69548
25.	65434.6	40851.5	31.0	84721.5	64.4	22375.1	17.0	-16296.1	-12.4	131651.9	100	199032
26.	94767.0	47107.1	23.9	-44893.1	-22.8	138224.6	70.2	56534.3	28.7	196972.9	100	294707
27.	65305.7	57540.6	151.6	19356.1	51.0	-5878.4	-15.5	-33056.8	-87.1	37961.5	100	103101
28.	220806.4	184265.4	30.5	379284	62.9	46836.6	7.7	-5336.9	-0.9	605049.1	100	822691
29.	44329.9	53289.0	49.5	-18639.1	-17.3	44986.1	41.8	28017.1	26.0	107652.9	100	154461
30.	271846.6	302632.8	861.2	-58757.1	-167.2	-112758	-320.9	-95975.6	-273.1	35141.3	100	313229
31.	365839.0	381372.6	70.2	-153557	-28.3	185466.3	34.1	129988.5	23.9	543270.2	100	886462
32.	85269.9	48464.3	66.3	205197.2	280.7	-46620.8	-63.8	-133927	-183.2	73112.8	100	143016
33.	191533.2	172811.4	94.7	-27669.1	-15.2	40094.4	22.0	-2680.4	-1.5	182556.3	100	371564
34.	58633.1	66851.2	249.4	-77977.2	-290.9	31156.6	116.2	6777.4	25.3	26808.1	100	84715
35.	17459.3	20502.6	30.7	11875.6	17.8	16676.8	25.0	17752.4	26.6	66807.4	100	84262
36.	77816.5	67817.9	19.6	230103.6	66.4	31315.5	9.0	17182.5	5.0	346419.5	100	420177
37.	109828.1	108638.9	26.4	211422.4	51.5	48095.8	11.7	42619.2	10.4	410776.4	100	519134
38.	315595.5	294855.7	43.1	277243.9	40.6	58237.0	8.5	53076.0	7.8	683412.7	100	996054
39.	1564777	1779547	178.8	-676319	-68.0	-26283.4	-2.6	-81935.8	-8.2	995008.2	100	2560738
40.	220013.2	179887.3	26.9	164630.6	24.6	170429.2	25.5	153649.4	23.0	668596.7	100	882907
41.	268110.2	240645.6	103.2	-29275.1	-12.5	32532.8	13.9	-10611.8	-4.5	233291.4	100	505678
42.	558847.6	499511.0	54.6	56001.1	6.1	195196.0	21.3	163789.7	17.9	914497.9	100	1473401
43.	57781.1	48418.3	49.9	21507.8	22.2	13062.9	13.5	14083.0	14.5	97072.0	100	154953
44.	1560558	1378699	70.2	453161.7	23.1	128313.5	6.5	3595.7	0.2	1963770	100	3530174
45.	227298.4	191956.4	38.6	73049.5	14.7	134985.0	27.2	96809.3	19.5	496800.3	100	722196
46.	1762039	1536416	62.2	722555.4	29.3	96996.4	3.9	112970.1	4.6	2468938	100	4226102
Total	17661936	15038257	84.5	1041307	5.9	1300568	7.3	416937.3	2.3	17797071	100	35428688
Increase in Output Due to		Average Growth of F.D. 15038257/ 17661936 = 85.1%		Change in Composition of F.D. 1041307/17661936 = 5.9%		Technical Change 1300568/17661936 = 7.4%		Interaction Factor 416937.3/17661936 = 2.4%		Total Increase in Output 17797071/ 17661936 =100.8%		

A study of the sectoral details shows that the average growth effect of Oil and Gas (9) was negative over the entire period under study. The reasons for this have already been explained. The average growth effect of all the other sectors was positive during 1968-69 to 1983-84. This effect was very high for some sectors like Agriculture (1, 2, 3, 4), Forestry and Logging (6), Fishing (7), Beverages (14), Tobacco Products (15), Leather (21), Non Metallic Minerals other than Cement (30), Agricultural Machinery (34) and Construction (39). That is, had the final demand of these sectors been growing at the average growth rate, these sectors would have contributed significantly to output increase during 1968-69 to 1983-84. But in actuality the final demand of all these sectors except Forestry and Logging (6) grew much below average as reflected by the negative effect on output, of a change in the composition of final demand of these sectors. That is, the effect of shifts in the composition of final demand reveal some broad trends for the same total period. Due to this factor there was a significant decline in the production of sectors like Agriculture (1, 2, 3, 4), Animal Husbandry (5), Fishing (7), Other Minerals (11), Beverages (14), Tobacco Products (15), Wood (19), Leather (21), Petroleum Products (23), Fertilisers (26), Cement and Other Non Metallic Minerals (29, 30), Iron and Steel (31), Metal Products and Agricultural Machinery (33, 34), Construction (39) and Railway Transport Service (41). These are chiefly the traditional sectors of our economy. All other sectors grew into importance over the same period chief among them being Mining (8, 9, 10), Food Products

(12, 13), Textiles (16, 17, 18), Paper (20), Rubber and Plastic Products (22), Chemicals (25, 27, 28), Other Basic Metal Industry (32), Machinery except Agricultural Machinery (35, 36, 37), Transport Equipment (38), Electricity, Gas, Water Supply (40) and all Services (42, 43, 44, 45, 46). That is, final expenditures changed in favour of textiles, paper, chemicals, machinery and electric power reflecting the development of the Indian economy.

The effects of technical change on production levels show a decline in the demand for the outputs of sectors like Agriculture (1, 2, 3, 4), Forestry (6), Coal and Lignite (8), Food Products (13), Wood (19), Paper (20), Rubber and Plastic Products (22), Non Metallic Minerals (30), Other Basic Metal Industry (32) and Construction (39). This reflects a decline in size and weight of items produced with these materials and the substitution of other materials for the outputs of these industries. In place of these, due to the effects of technical change there has been an increase in the demand of outputs from Oil and Natural Gas (9), Textiles (16, 17, 18), Leather (21), Petroleum and Coal Tar Products (23, 24), Chemicals (25, 26, 28), Cement (29), Iron and Steel (31), Machinery (34, 35, 36, 37), Transport Equipment and Miscellaneous Manufacturing (38), Electricity, Gas, Water Supply (40) and all Services (41, 42, 43, 44, 45, 46).

The share of the interaction factor in the total output change over the 15 year period was 2.3% only. However, it was very significant in some sectors like Plantation Crops (3), Forestry and Logging (6), Wood (19), Non Metallic Minerals (30) and Other Basic Metal Industry (32). That is, in these sectors specially the contribution of the other three components would

have been significantly different over the period 1968-69 to 1983-84, had this factor not been separated out.

Thus, in the period 1968-69 to 1983-84 average growth effect contributed 84.5% of the total output change, composition of final demand effect contributed 5.9%, technical change effect 7.3% while the contribution of the interaction effect in the total change in output was 2.3%. The three subperiods show similar trends but with some fluctuations.

Before we conclude this section we feel that it is necessary to repeat that there may be some distortion in the results presented here on account of deflation of the 1968-69, 1973-74 and 1978-79 tables to a constant price base (see chapter 3 also). Where the results involve the 1968-69 I-O table the distortions may be higher on account of this table being in a commodity x industry form.

5.4 CONTRIBUTION OF FINAL DEMAND CATEGORIES TO OUTPUT GROWTH

In this section changes in output are broken down into changes in five final demand factors : private consumption (PFCE), government consumption (GFCE), gross investment (GI), exports (EXP) and imports (IMP). This is done by computing the identities implied in equations 5.11 as explained in section 5.1.2. In the previous section the effect of changes in final demand on output change was analysed by grouping the different categories of final demand together under one head. In this section we go a step further by capturing the separate effects of changes in different components of final demand (PFCE, GFCE, GI, EXP and IMP) on output change. A subdivision of this kind, it is

felt, is very useful for identifying the effects of economic policies on economic growth and structural change because it illustrates the different ways in which various policies affect the individual components of final demand. The above analysis is again done for the three subperiods 1968-69 to 1973-74, 1973-74 to 1978-79, 1978-79 to 1983-84 as well as for the entire period 1968-69 to 1983-84 under study. This is shown in Tables 5.8, 5.9, 5.10 and 5.11 respectively.

Table 5.8 shows the percentage contributions to changes in output, of changes in PFCE, GFCE, GI, EXP and IMP for the first subperiod 1968-69 to 1973-74. The figures across each row in all the four tables sum to 100%.

During the period 1968-69 to 1973-74, when total output grew at the rate of 3.3% a year, the major impetus to growth came from increases in gross investment (GI) and private consumption (PFCE) which recorded a contribution of 44.1% and 37.4% in the total output increase, respectively. Government consumption (GFCE) contributed 14.1% while the contribution from exports and imports were much smaller at 7.6% and -3.2% respectively.

A closer examination of Table 5.8 reveals an interesting pattern associated with sectoral characteristics. The Agriculture (1, 2, 3, 4), Animal Husbandry, Forestry and Fishing (5, 6, 7), Coal and Lignite (8), Food, Beverages and Tobacco (12, 13, 14, 15), Textiles (17, 18), Paper (20), Petroleum Products (23), Chemicals (25, 26, 27, 28), Other Basic Metal Industry (32), Electricity, Gas, Water Supply (40) and Services (42, 43, 44, 45, 46) sectors grew mostly because of increases in consumption (both

CONTRIBUTION OF FINAL DEMAND CATEGORIES TO OUTPUT GROWTH DURING 1968-69 TO 1973-74 (PERCENT)

Sector No.*	Private Consumption (PFCE)	Government Consumption (GFCE)	Gross Investment (GI)	Exports (EXP)	Imports (IMP)	Total
1.	59.3	-0.5	31.0	0.9	9.3	100
2.	34.6	1.1	34.7	25.6	3.9	100
3.	88.0	-0.3	-0.2	11.8	0.6	100
4.	49.3	3.7	63.3	-6.8	-9.5	100
5.	174.9	-1.7	-66.2	-8.0	0.9	100
6.	56.4	5.4	42.1	0.4	-4.3	100
7.	72.8	16.4	59.4	-35.4	-13.2	100
8.	109.8	7.8	3.7	18.2	-39.5	100
9.	-162.1	-75.1	-131.6	-21.7	490.4	100
10.	7.0	4.8	23.1	77.0	-11.9	100
11.	21.5	-36.2	-370.8	-28.6	514.1	100
12.	136.3	-1.3	-18.1	-15.8	-1.1	100
13.	79.6	-1.0	11.4	15.4	-5.5	100
14.	108.4	-0.1	-7.7	-0.2	-0.5	100
15.	111.8	-0.2	-10.7	-0.9	0.0	100
16.	9.0	-4.3	48.6	46.1	0.6	100
17.	70.2	4.0	18.7	4.6	2.4	100
18.	76.9	-15.1	52.7	-21.4	6.9	100
19.	-46.0	1.9	158.2	-17.9	3.9	100
20.	44.1	27.9	23.0	3.1	2.0	100
21.	-121.7	7.8	85.8	128.3	-0.2	100
22.	11.0	-36.4	61.1	15.8	48.5	100
23.	-16.1	243.0	425.6	41.6	-594.1	100
24.	-72.9	4.3	178.3	-9.6	-0.1	100
25.	35.7	8.3	31.6	22.8	1.6	100
26.	168.7	5.1	-69.0	-0.8	-4.1	100
27.	230.8	20.2	-67.4	-16.5	-67.1	100
28.	69.9	4.4	23.3	8.5	-6.2	100
29.	1.1	10.4	87.9	-0.7	1.3	100
30.	56.3	-9.3	49.5	1.4	2.1	100
31.	18.1	15.9	108.0	-6.2	-35.8	100
32.	9629.5	1437.8	6386.2	1604.1	-6185.2	100
33.	-11.6	9.3	100.3	10.0	-8.0	100
34.	282.8	0.4	-526.3	-13.2	356.3	100
35.	33.6	0.7	66.8	10.5	-11.7	100
36.	13.9	3.1	71.8	3.9	7.3	100
37.	11.2	6.5	84.8	1.3	-3.7	100
38.	13.0	15.2	53.1	2.8	15.9	100
39.	78.8	-56.6	96.3	13.3	-31.9	100
40.	37.9	40.3	27.6	2.7	-8.5	100
41.	-22.7	11.7	112.3	10.0	-11.3	100
42.	110.5	-25.7	1.8	10.2	3.3	100
43.	21.5	82.7	-5.4	-0.8	2.0	100
44.	61.6	7.3	20.5	9.9	0.7	100
45.	71.8	4.0	24.5	-1.5	1.2	100
46.	42.2	54.9	3.1	-0.7	0.5	100
Total	37.4	14.1	44.1	7.6	-3.2	100

* For Sector Specifications see Table 3.1, Chapter 3

PFCE and GFCE but mainly PFCE) demand whereas Wood (19), Leather (21), Rubber, Plastic, Petroleum and Coal Tar Products (22, 23, 24), Cement (29), Non Metallic Minerals (30), Iron, Steel and Other Basic Metal Industry (31, 32), Machinery (35, 36, 37), Transport Equipment (38), Construction (39) and Railway Transport Service (41) depended on increases in investment. These results are consistent with the characteristics of different sectors. Export demand was a relatively important source of output growth in the Iron Ore (10), Cotton Textiles (16), Leather (21), Petroleum Products (23) and Other Basic Metal Industry (32) sectors while the impact of change in imports led to the growth of Oil and Natural Gas (9), Other Minerals (11), Rubber and Plastic Products (22) and Agricultural Machinery (34) sectors over the period 1968-69 to 1973-74.

A negative impact of exports on output growth of any sector implies that exports of that sector decreased in 1973-74 as compared to that of 1968-69 and due to this decline in exports, output of that sector declined over the same period. On the other hand, a negative impact of imports on output growth of any sector implies that imports of that sector increased in 1973-74 as compared to 1968-69 and due to this increase in imports, output of that sector declined over the period under study as imports are regarded as a substitute for domestic supply.

The results of similar computations for the second subperiod 1973-74 to 1978-79 are reported in Table 5.9. During this period output grew at 5.9% annually. In this period the expansion of consumption demand was more important than that of investment. Consumption demand (both PFCE and GFCE) contributed 78% of the

CONTRIBUTION OF FINAL DEMAND CATEGORIES TO OUTPUT GROWTH DURING 1973-74 TO 1978-79 (PERCENT)

Sector No.*	Private Consumption (PFCE)	Government Consumption (GFCE)	Gross Investment (GI)	Exports (EXP)	Imports (IMP)	Total
1.	77.0	-2.8	-8.7	11.4	23.0	100
2.	157.4	3.6	-101.8	31.3	9.4	100
3.	100.3	0.2	-14.0	-16.6	30.0	100
4.	135.9	-8.9	-46.5	21.7	-2.2	100
5.	103.5	-1.7	-3.7	4.5	-2.6	100
6.	381.5	-24.9	-280.5	51.9	-28.0	100
7.	187.1	-9.8	-30.8	-48.1	1.6	100
8.	57.9	6.3	49.0	26.4	-39.7	100
9.	192.5	39.5	49.2	51.7	-233.0	100
10.	14.1	-7.6	-79.0	163.0	9.5	100
11.	26.8	1.9	27.1	36.8	7.3	100
12.	55.7	0.1	35.8	13.1	-4.7	100
13.	109.1	0.1	8.2	9.2	-26.5	100
14.	118.3	0.4	-18.4	1.4	-1.7	100
15.	-319.7	-6.9	-70.8	498.1	-0.8	100
16.	80.8	-0.9	17.7	3.2	-0.7	100
17.	107.8	-2.4	-3.8	2.0	-3.5	100
18.	71.4	2.1	1.9	29.4	-4.7	100
19.	47.2	5.7	50.0	3.2	-6.1	100
20.	95.7	14.3	33.5	30.2	-73.6	100
21.	198.3	-8.4	-244.4	155.3	-0.8	100
22.	45.5	8.4	47.6	24.9	-26.4	100
23.	108.7	19.2	15.5	29.1	-72.5	100
24.	81.2	14.2	-16.0	29.2	-8.6	100
25.	81.1	5.7	38.8	22.0	-47.6	100
26.	147.6	0.8	-27.4	5.5	-26.5	100
27.	31.5	7.1	63.1	13.9	-15.6	100
28.	95.9	4.7	28.7	19.0	-48.4	100
29.	53.3	9.0	289.1	21.4	-272.8	100
30.	38.4	3.4	37.1	77.7	-56.6	100
31.	36.0	6.4	60.3	28.0	-30.7	100
32.	29.5	3.8	56.9	41.1	-31.2	100
33.	-26.1	21.6	121.2	-34.7	17.9	100
34.	27.1	8.5	98.3	8.6	-42.4	100
35.	-8.4	0.8	118.1	-17.0	6.5	100
36.	75.9	9.3	67.4	39.0	-91.7	100
37.	23.4	-10.0	63.2	38.5	-15.1	100
38.	80.4	17.2	13.0	37.7	-48.4	100
39.	10.7	5.6	84.2	2.0	-2.5	100
40.	65.1	3.1	32.3	12.7	-13.2	100
41.	77.7	3.5	12.9	15.3	-9.4	100
42.	83.0	0.5	12.2	14.0	-9.7	100
43.	52.2	16.1	31.0	21.7	-21.1	100
44.	78.3	2.4	12.3	13.2	-6.2	100
45.	73.0	20.2	4.2	11.0	-8.3	100
46.	47.4	33.6	13.5	12.5	-7.0	100
Total:	72.5	5.6	21.4	16.5	-15.9	100

* For Sector Specifications see Table 3.1, Chapter 3

total output growth in this period as compared to 51% in the previous period. The share of government consumption shows a decline while that of private consumption shows an increase in its share within the consumption category as compared to corresponding figures of the first subperiod. Gross investment contributed 21.4% which was much lower than that of the 1968-69 to 1973-74 period. This change in the relative shares of consumption and investment demand as sources of output growth may indicate that the Indian economy was going through a structural change from an investment-oriented economy to a more consumption-oriented one in the period 1973-74 to 1978-79. In addition, in this period, the absolute values of export expansion and import expansion increased substantially from their 1968-69 - 1973-74 levels to 16.5% and -15.9% respectively. Unlike the sectoral contributions of export expansion and import expansion in the 1968-69 to 1973-74 period (which include both positive and negative values in both categories), all of the sectoral values of export expansion are positive during the 1973-74 to 1978-79 period and all of the values of import expansion are negative. That is, exports and imports of all sectors increased in 1978-79 as compared to 1973-74. Increase in exports led to increase in output (hence positive values) while increase in imports led to decrease in output (hence negative values). These phenomena reflect the opening up of the Indian economy.

Rising consumption demand was an important source of output growth in the same sectors during 1973-74 to 1978-79 as it had been in the 1968-69 to 1973-74 period. In addition, increasing

consumption demand contributed significantly to output growth in the Oil and Gas (9), Leather (21) and Transport Equipment and Miscellaneous Manufacturing (38) sectors. Similarly all the sectors (except Railway Transport Service) where the contribution from investment demand had been significant in the earlier period also gained in a similar manner during 1973-74 to 1978-79. In the Oil and Gas (9) sector, the contribution from investment expansion increased drastically alongwith an increase in consumption as compared to the previous period while in the Agriculture sectors (1, 2, 3, 4, 5, 6, 7) the contribution of investment demand was negative during 1973-74 to 1978-79.

Although the contribution from export expansion increased more or less in almost every sector between 1973-74 and 1978-79, the importance of export expansion was not uniform across sectors. In addition to Iron Ore (10), Leather (21) and Other Basic Metal Industry (32) where export contribution was also significant during 1968-69 to 1973-74, the growth of output in Forestry (6), Oil and Gas (9), Other Minerals (11), Tobacco Products (15), Non Metallic Minerals (30), Machinery (36, 37) and Transport Equipment and Misc. Manufacturing (38) sectors was also substantially caused by export expansion during 1973-74 to 1978-79.

Import expansion had a negative impact in almost all sectors between 1973-74 and 1978-79, as noted above, implying an increase in imports in almost all sectors in 1978-79 as compared to 1973-74. The magnitude of this effect is relatively large in five sectors : Oil and Gas (9), Paper (20), Petroleum Products (23), Cement (29) and Other Machinery (36).

Table 5.10 shows the final demand categories' contribution to output growth for the period 1978-79 to 1983-84. During this period, total output increased at the rate of 5.1% annually. In this period too consumption demand was more important than investment demand. While consumption demand (both PFCE and GFCE) contributed 82% which was higher than the 1973-74 to 1978-79 period, investment demand contributed 26.3% which was also higher than the 1973-74 to 1978-79 level. The contributions from export and import expansion were 3.2% and -11.6% respectively, which were lower than the second subperiod levels. We notice that while the positive impact of exports was greater than the negative impact of imports in both the first and the second subperiods, in the third subperiod 1978-79 to 1983-84 there was a reversal of this situation. In this period the negative impact of imports on output growth was considerably larger than the positive impact of exports.

Rising consumption demand had almost similar impacts during 1978-79 to 1983-84 as compared to the second subperiod. The few differences were a drastic reduction in the impact of consumption demand on Fishing (7) and Sugar (12) sectors while an increase in Iron, Steel (31), Metal Products excluding Machinery (33) and Agricultural Machinery (34) sectors. Similarly the trend observed due to investment expansion in the first two subperiods was also witnessed in the third subperiod. The only differences were a significant increase in the contribution of investment demand in Other Minerals (11), Sugar (12) and Metal Products excluding Machinery (33) sectors in the third subperiod as compared to the

CONTRIBUTION OF FINAL DEMAND CATEGORIES TO OUTPUT GROWTH DURING 1978-79 TO 1983-84 (PERCENT)

Sector No.*	Private Consumption (PFCE)	Government Consumption (GFCE)	Gross Investment (GI)	Exports (EXP)	Imports (IMP)	Total
1.	83.3	1.8	35.4	-1.9	-18.6	100
2.	102.4	7.1	-81.7	11.0	1.2	100
3.	-387.3	-0.7	4.8	757.9	-274.7	100
4.	86.2	1.7	16.2	-3.1	-1.0	100
5.	96.5	0.8	6.3	-1.7	-1.9	100
6.	75.1	5.1	21.8	-2.1	0.1	100
7.	-507.8	-9.9	-37.7	650.2	5.1	100
8.	73.1	15.3	26.8	0.0	-15.3	100
9.	69.9	6.1	14.8	72.0	-62.7	100
10.	7.6	3.6	25.1	75.4	-11.6	100
11.	39.2	15.2	103.6	1.5	-59.5	100
12.	-8039.6	42.6	8200.4	460.6	-564.0	100
13.	108.7	0.2	-0.3	-26.1	17.5	100
14.	99.6	0.1	0.6	-0.0	-0.3	100
15.	127.0	1.5	-5.9	-22.2	-0.3	100
16.	109.8	9.4	-15.6	-1.6	-2.1	100
17.	72.8	2.1	27.2	1.8	-3.9	100
18.	82.5	10.0	0.8	8.1	-1.4	100
19.	-254.2	65.5	282.2	-26.2	32.7	100
20.	81.9	19.7	12.8	3.8	-18.1	100
21.	27.3	1.1	82.8	-8.0	-3.2	100
22.	27.4	0.5	74.8	0.5	-3.2	100
23.	82.6	9.0	20.1	15.2	-26.9	100
24.	13.9	13.5	105.5	-8.1	-24.9	100
25.	157.6	21.4	63.2	-14.6	-127.6	100
26.	102.3	2.2	-30.9	2.6	23.9	100
27.	22.1	15.4	61.7	0.5	0.4	100
28.	49.3	8.4	43.7	5.1	-6.5	100
29.	17.7	10.9	67.1	8.1	-3.8	100
30.	-21.5	2.3	79.1	-3.2	43.2	100
31.	29.6	26.1	194.1	-63.8	-85.9	100
32.	189.6	67.2	200.6	-246.8	-110.6	100
33.	65.5	5.3	57.8	-3.6	-25.0	100
34.	113.0	3.7	-18.8	3.5	-1.5	100
35.	17.8	3.6	122.3	-3.7	-40.0	100
36.	-31.5	7.2	174.0	13.3	-63.1	100
37.	25.4	5.1	100.5	-0.1	-31.0	100
38.	18.5	4.5	65.2	24.6	-12.8	100
39.	18.9	18.8	63.8	1.0	-2.4	100
40.	62.9	15.5	29.5	4.1	-12.1	100
41.	60.5	13.5	42.5	-1.6	-14.9	100
42.	82.1	7.2	19.0	7.9	-16.1	100
43.	85.0	0.4	16.9	4.8	-7.2	100
44.	94.4	1.2	101.1	-84.7	-12.0	100
45.	53.7	10.0	45.8	11.2	-20.6	100
46.	65.8	28.2	5.9	3.8	-3.7	100
Total	70.5	11.6	26.3	3.2	-11.6	100

* For Sector Specifications see Table 3.1, Chapter 3

earlier two subperiods.

The growth of output in Plantation Crops (3), Fishing (7), Oil and Gas (9), Iron Ore (10) and Sugar (12) sectors was substantially caused by export expansion during 1978-79 to 1983-84. On the other hand, the negative impact of import expansion was particularly large in Plantation Crops (3), Oil and Gas (9), Other Minerals (11), Sugar (12), Basic Heavy Chemicals (25), Iron, Steel and Other Basic Metal Industry (31, 32) and Machinery (35, 36, 37). Like the contribution of export and import expansion during 1968-69 to 1973-74, in the third subperiod also both categories include both positive and negative values.

Before we conclude this section we will analyse the results for the total period 1968-69 to 1983-84 under study. Table 5.11 gives the results for the entire period. From Table 5.11 we see that the contribution of changes in private consumption and public consumption to output growth were 65.5% and 9.7% respectively, which sum up to 75%. The contribution of gross investment, exports and imports were 27.5%, 9.1% and -11.8% respectively over the same period. Output during this period grew at the rate of 4.8% annually.

The overall sectoral trends witnessed show that Agriculture (1, 2, 3, 4), Animal Husbandry, Forestry and Fishing (5, 6, 7), Coal, Lignite, Oil and Gas (8, 9), Food (12, 13), Beverages and Tobacco (14, 15), Textiles (16, 17, 18), Wood and Paper (19, 20), Petroleum Products (23), Chemicals (25, 26, 28), Non Metallic Minerals (30), Agricultural Machinery (34), Electricity, Gas, Water Supply (40) and Services (41, 42, 43, 44, 45, 46) were the sectors which grew mostly because of increases in consumption

Table 5.11

CONTRIBUTION OF FINAL DEMAND CATEGORIES TO OUTPUT GROWTH DURING 1968-69 TO 1983-84 (PERCENT)

Sector No.*	Private Consumption (PFCE)	Government Consumption (GFCE)	Gross Investment (GI)	Exports (EXP)	Imports (IMP)	Total
1.	74.1	-0.1	23.1	2.3	0.6	100
2.	76.7	3.8	1.7	16.6	1.3	100
3.	96.0	-0.7	12.3	7.5	-15.1	100
4.	90.0	-0.5	11.6	2.4	-3.4	100
5.	94.5	0.0	6.8	1.0	-2.3	100
6.	254.8	-8.4	-160.8	13.1	1.2	100
7.	65.8	1.3	6.7	30.5	-4.3	100
8.	53.6	12.2	46.6	10.4	-22.8	100
9.	113.8	19.8	35.2	77.8	-146.6	100
10.	8.0	2.9	11.8	86.5	-9.2	100
11.	35.4	13.1	102.6	17.2	-68.3	100
12.	86.2	0.1	0.3	15.7	-2.3	100
13.	101.2	-0.2	7.0	2.4	-10.4	100
14.	124.5	-1.0	-21.9	-1.8	0.3	100
15.	88.5	4.2	-5.5	13.9	-1.0	100
16.	82.8	2.7	8.7	6.9	-1.1	100
17.	82.8	1.1	16.4	2.4	-2.7	100
18.	75.3	2.2	8.2	16.7	-2.3	100
19.	66.0	25.6	-2.8	17.6	-6.4	100
20.	76.5	20.2	20.9	10.8	-28.4	100
21.	27.4	0.7	19.8	54.2	-2.1	100
22.	28.6	-2.6	68.3	6.8	-1.1	100
23.	85.8	4.3	25.3	18.0	-43.3	100
24.	-9.4	9.6	109.9	-0.1	-10.0	100
25.	82.2	8.9	41.0	16.2	-48.3	100
26.	114.2	1.2	-24.9	4.2	5.2	100
27.	-18.5	7.7	92.5	15.1	3.2	100
28.	66.0	6.5	34.6	9.4	-16.5	100
29.	14.8	10.6	86.6	6.2	-18.3	100
30.	177.9	17.2	-82.7	354.6	-367.0	100
31.	30.3	11.8	92.2	5.7	-40.0	100
32.	6.4	4.3	97.6	5.8	-14.1	100
33.	44.4	3.3	65.9	12.7	-26.4	100
34.	110.0	4.6	-44.7	3.0	27.2	100
35.	32.2	1.8	81.7	8.2	-23.9	100
36.	14.1	5.7	101.6	14.6	-36.0	100
37.	19.2	3.2	87.8	6.9	-17.0	100
38.	26.8	11.2	51.1	17.7	-6.8	100
39.	10.5	15.1	74.4	0.9	-0.8	100
40.	59.4	16.0	30.0	6.4	-11.8	100
41.	56.3	8.5	38.9	8.1	-11.8	100
42.	85.8	0.4	14.0	10.8	-11.1	100
43.	64.8	19.1	17.0	8.6	-9.5	100
44.	74.8	3.6	17.2	9.2	-4.8	100
45.	66.8	13.7	21.2	8.4	-10.2	100
46.	58.4	33.2	7.2	5.1	-3.8	100
Total	65.5	9.7	27.5	9.1	-11.8	100

* For Sector Specifications see Table 3.1, Chapter 3

(both PFCE and GFCE) demand. In the consumption category PFCE played a major role as compared to GFCE. On the other hand, sectors which depended on increases in investment during the same period were Other Minerals (11), Rubber, Plastic and Coal Tar Products (22, 24), Paints (27), Cement (29), Iron, Steel and Other Metal Industry (31, 32), Metal Products (33), Machinery except Agricultural Machinery (35, 36, 37), Transport Equipment (38), and Construction (39).

All the values of export expansion are positive during 1968-69 to 1983-84 while all the values of import increase are negative. The contribution of export expansion was significant in the growth of output in Fishing (7), Oil and Gas (9), Iron Ore (10), Leather (21) and Non Metallic Minerals (30). The negative impact of import expansion was significant in sectors like Oil and Gas (9), Other Minerals (11), Petroleum Products (23), Basic Heavy Chemicals (25), Non Metallic Minerals (30) and Iron and Steel (31).

In sum, output growth in the Indian economy during 1968-69 to 1983-84 was largely attributable to the growth in consumption and investment demand. The importance of consumption increased over time in relation to that of investment. At the same time, the significance of foreign trade also increased. The role of foreign trade was particularly high in the second subperiod 1973-74 to 1978-79.

5.5 SUMMARY

This chapter employed Indian Input-Output tables to analyse changes in the structure of production in the Indian economy over

the period 1968-69 to 1983-84 and decomposed any output changes into different sources of growth. The output or production structure was defined as any sector's share in the total output of the economy. The changes in output were factored into the effects of change in the level of final demand, change in the composition (or distribution) of final demand, change in I-O coefficients and change in the interaction (of final demand change and I-O coefficient change) factor. Further, the contribution of individual final demand categories to output growth were also analysed. The total period 1968-69 to 1983-84 was divided into three subperiods viz. 1968-69 to 1973-74, 1973-74 to 1978-79 and 1978-79 to 1983-84 and the above analysis was conducted for the three subperiods as well as for the entire period under study.

The results showed that the structure of Indian production diverted from agriculture to industry, especially to heavy industry and to services over the period 1968-69 to 1983-84.

The results of the sources of output growth showed that over the period 1968-69 to 1983-84, due to changes in the level of final demand, total output increased by 85 percent while the increase in output due to changes in the composition of final demand, changes in I-O coefficients and the interaction effect were 5.9%, 7.4% and 2.4% of the initial output level of 1968-69, respectively.

The average growth effect was clearly the most significant factor affecting production levels in the Indian economy. This factor alone accounted for 85% of the total increase in output

during 1968-69 to 1983-84. This effect was highly significant for sectors like agriculture, fishing, beverages, tobacco products, leather, non metallic minerals except cement, agricultural machinery and construction. This explains that had the final demand of these sectors been growing at the average growth rate, these sectors would have contributed significantly to output increase during the period 1968-69 to 1983-84. But in actuality the final demand of these sectors grew much below average as reflected by the negative impact on output, of a change in the composition of final demand of these sectors. That is, the effects of changes in the composition of final demand showed a decline in the demand of the output of traditional industries (listed above) and an increase in the demand of industries like textiles, paper, chemicals, machinery and electric power. Overall, the change in the composition of final demand had a relatively minor effect (5.9%) on the total change in output during 1968-69 to 1983-84. The fact that this factor resulted in an increase in production shows that those sectors which required relatively large amounts of intermediate inputs in their production activities (sectors like chemicals, paper, machinery etc. listed above) received larger weights in the 1983-84 expenditure vector as compared to the 1968-69 vector.

The effects of technical change also had a relatively modest impact (7.3%) on the change in production levels during the same period 1968-69 to 1983-84. Due to this effect there was a decline in the demand of the outputs of sectors like agriculture, food products, wood, paper, rubber and plastic products, coal and lignite, non metallic minerals and

construction. This reflects a substitution of these materials by other materials. On the other hand, technical development increased the outputs of oil and gas, textiles, leather, petroleum and coal tar products, chemicals, cement, iron and steel, machinery, transport equipment, electric power and services over the same period as shown by the results of the analysis conducted.

The contribution of the interaction factor in the total change in output during 1968-69 to 1983-84 was 2.3%. The contribution of this component of output growth showed the amount by which the contribution of the other three components would have been different had this factor not been separated out.

These trends as witnessed for the total period 1968-69 to 1983-84 were also observed for the three subperiods but with some fluctuations. The results showed that structural change was fastest during the second subperiod 1973-74 to 1978-79.

Finally, the results of the analysis of different final demand categories showed that over the period 1968-69 to 1983-84, output growth in the Indian economy was largely due to the growth in consumption (mainly private consumption) demand and investment demand. The importance of consumption increased in relation to that of investment and the role of foreign trade also increased during the period 1968-69 to 1983-84.

In the next chapter we deal with the empirical analysis of the structural change in technology in India.

CHAPTER 6

STRUCTURAL CHANGE : ANALYSIS OF CHANGE IN TECHNOLOGY

In an economy as large and complex as the Indian economy, it is reasonable to assume that changes in the technical relationships of production occur slowly and in an orderly manner. But over time, as new products are introduced, new materials substituted for old ones, technologies upgraded and new technologies incorporated into production processes, changes in technical relationships do occur and are likely to be quite varied among the different sectors of the economy. In this chapter we shall examine the changes in the most important Input-Output coefficients in India over the period 1968-69 to 1983-84. In the previous chapter we studied how changes in all Input-Output coefficients taken together caused changes in the Leontief inverse matrix which in turn caused changes in the output of industries assuming that final demand remained constant. How much have the Input-Output coefficients changed and how important are the changes in individual coefficients to development of output of industries ? These issues form the subject matter of this chapter.

This chapter is divided into three sections. The methodology used in the analysis is explained in section 6.1. In section 6.2 changes in the most important Input-Output coefficients of the Indian economy are measured and finally section 6.3 gives a summary of the analysis of this chapter.

6.1 METHODOLOGY

We define changes in Input-Output coefficients as changes in technology. Defining change in technology in this manner implies a very broad view of what constitutes technological change. Changes in I-O coefficients cannot be attributed solely to changes in technology (i.e. changes in production functions), but may be the result of many factors like changes in the product mix of individual sectors, divergences in actual technical relationships from the basic assumptions of I-O analysis, changes in relative prices, changes in technology including quality of inputs and observation errors and other statistical factors (Vaccara, 1970). Since further study would be needed to sort out what actually caused the changes in the coefficients, our analysis treats all these as technological change.

In the existing literature on I-O analysis, there are two basic approaches for studying changes in technology. The first approach measures the change in individual I-O coefficients or the sum of the changes in the column coefficients of sectors over two time periods and treats this measure as reflecting the degree of change in technology. The second approach measures technological change as the impact of change in individual I-O coefficients on the output of industries[1]. We have adopted the second approach for measuring changes in technology for the Indian economy over the period 1968-69 to 1983-84. We feel that technological change cannot be studied with the help of change in I-O coefficients only. Technological change must be studied not

1. For a review of studies on the two approaches refer to Chapter 2, section 2.2.2.

in isolation but with reference to its impact on the economy. Hence we follow the second approach for analysing changes in technology in this study.

In this chapter we wish to investigate the importance of individual Input-Output coefficients. The importance of a coefficient (of the technical coefficient matrix, A) for the purpose of this study, is determined by measuring the effects of changes in coefficients on output of industries. This measurement is based on the Sherman-Morrison lemma (Forssell, 1988b). It states how each element of the inverse matrix changes, given the change in one element of the original matrix A. The Sherman-Morrison lemma provides a very useful approach for studying the links between changes in Input-Output coefficients and their effects on growth of output. Such a measure I_{ab} indicates the percentage by which an Input-Output coefficient K_{ab} [which is an element of (I-A) matrix] may change so that the output of any industry does not change by more than 1%,

$$I_{ab} = \frac{1}{K_{ab}} \left[\max_i \left(\frac{R_{ia}}{X_i}\right) X_b + 0.01\, R_{ba} \right] \qquad - 6.1$$

where R_{ia}, R_{ba} represent elements of the Leontief inverse matrix, X_i, X_b represent elements of the gross output vector and K_{ab} is an element of the (I-A) matrix.

All the variables in equation (6.1) are at terminal year values. Final demand is held constant while computing the measure I_{ab}. This formula given in equation (6.1) was developed by Maenpaa (1981). The smaller the value of the measure I_{ab}, the more important the Input-Output coefficient is, because even

small changes in it have effects on output. This measure has been computed for the 1968-69, 1973-74, 1978-79 and 1983-84 Input-Output coefficients to find out their individual importance to development of output of Indian industries. At the next stage 100 most important Input-Output coefficients on the basis of the significance of their changes on development of output of industries were selected and changes in them measured for the subperiods 1968-69 to 1973-74, 1973-74 to 1978-79 and 1978-79 to 1983-84. Changes have been measured pairwise as follows :

$$\frac{A_{ij}(t) - A_{ij}(o)}{A_{ij}(o)} \qquad - 6.2$$

where A_{ij} represents an element of technical coefficient matrix A, o and t refer to the base year and the terminal year, respectively of the subperiod under study. A minus indicates a decrease in the coefficient and a plus an increase. Suppose we wish to measure the range of changes in the 100 most important Input-Output coefficients over the period 1968-69 to 1973-74. The first step for this would be to select the 100 most important coefficients of 1968-69 on the basis of the measure I_{ab}. Next the value of these 100 coefficients in the year 1973-74 were noted and the range of changes in these coefficients calculated using equation 6.2.

The 100 most important coefficients of the four years under reference have also been used to find out the industries having the most significant impacts on the output development of other industries. This has been done simply by calculating the number

of coefficients which an industry has among the 100 most important Input-Output coefficients of the four reference years. The rows and columns of industries have been considered separately. The row coefficients indicate mostly the importance of products of this industry for technological development of other industries. Product innovations and improvements as well as substitutions are then primarily concerned. On the other hand, the column coefficients indicate mostly the importance of the production method of this industry for demand of output of other industries (Forssell, 1988a).

A final aspect of structural change in technology considered was to find out whether the size of Input-Output coefficients have any correlation with the size of changes in coefficients. Small coefficients are assumed to be more sensitive to changes than large coefficients (Forssell, 1988a). In order to verify this hypothesis the 100 most important Input-Output coefficients have been divided into two groups: (1) the coefficients with a value less than 0.10 in the base year and (2) the coefficients with a value more than 0.10 in the base year. Simple graphs have been used to test whether larger changes are associated with smaller coefficients or with the larger coefficients.

In the following section the above aspects will be taken up one by one for the Indian economy over the period under study.

6.2 CHANGES IN THE MOST IMPORTANT INPUT-OUTPUT COEFFICIENTS

In chapter 5 we investigated the effect of changes in all Input-Output coefficients as a whole on the output of Indian industries. In this chapter we wish to study technological change

in India over the period 1968-69 to 1983-84 in more detail. We wish to measure the importance of individual Input-Output coefficients to the development of output of industries. For this we use Maenpaa's formula given in equation (6.1) as explained in the previous section. The results of this measure for 1968-69, 1973-74, 1978-79 and 1983-84 Input-Output coefficients are presented in Table 6.1. The first column of Table 6.1 shows the range of measure of importance on the basis of the index I_{ab}. Each range of column 1 of Table 6.1 shows by how many percentage points an Input-Output coefficient can change without output changing more than one percent. From Table 6.1 we can see that among the 1968-69 Input-Output coefficients there were 142 such coefficients which could change only 0-5% without any output

Table 6.1

Number of Input-Output Coefficients According To Their Measure of Importance (I_{ab}) in 1968-69, 1973-74, 1978-79 and 1983-84.

Range of Measure of Importance	Number of Coefficients			
	1968-69	1973-74	1978-79	1983-84
0-5	142	142	149	145
5-10	59	49	41	62
10-20	63	64	73	68
20-50	114	117	125	122
50-100	99	125	118	98
over 100	663	885	1114	1000
zero coefficients	976	734	496	621
Total	2116	2116	2116	2116

Source : Computed from the 1968-69, 1973-74, 1978-79 and 1983-84 Input-Output tables of the order (46 x 46),all at 1983-84 prices.

changing more than 1%. This number was the same among the 1973-74 coefficients but was 149 among the 1978-79 and 145 among the 1983-84 coefficients. In the range of changes between 5 and 10% there were 59, 49, 41 and 62 coefficients in the years 1968-69, 1973-74, 1978-79 and 1983-84 respectively. Thus we see that the number of coefficients increased in the ranges with the most important coefficients in 1983-84 as compared to 1968-69. The number of zero coefficients decreased from 976 in 1968-69 to 621 in 1983-84. This reflects that technical development has strengthened the manufacturing base in India and increased relationships among industries making the economy more advanced. The number of coefficients in the range of changes between 10 to 20% and in the range 20-50% also increased over the period 1968-69 to 1983-84. The year 1978-79 shows more rapid changes as compared to the other three years showing that structural change in the production system was faster in that year and slightly different from the trend witnessed from 1968-69 to 1983-84.

We see from Table 6.1 that a rather small group of Input-Output coefficients is important when the significance of their changes on development of output of industries is considered. On the other hand, we see that there were 663 coefficients in 1968-69, 885 coefficients in 1973-74, 1114 coefficients in 1978-79 and 1000 coefficients in 1983-84 which could have changed separately over 100% without causing any change over 1% in the output of any industry.

It is useful to concentrate on the relatively small group of important Input-Output coefficients. These are the coefficients

even small changes in which have significant effects on output. It would be interesting then to study how great were the changes in the most important coefficients over the period 1968-69 to 1983-84. The entire period under study has been divided into three subperiods and changes in the 100 most important Input-Output coefficients have been measured during each subperiod using equation (6.2) as explained above. Table 6.2 gives the changes of the 100 most important coefficients between 1968-69 and 1973-74, 1973-74 and 1978-79 and between 1978-79 and 1983-84 according to their range of changes.

From Table 6.2 we see that there were 50 coefficients among the 100 most important coefficients which changed between 0 and 40% (both positive and negative) from 1968-69 to 1973-74. The number of coefficients in this range increased to 52 over the period 1973-74 to 1978-79 and further to 65 when the changes are observed from 1978-79 to 1983-84. It seems that Input-Output coefficients changed more over the period 1968-69 to 1973-74 as compared to the latter two subperiods. Thus we see that while there were 18 coefficients which changed more than 100% (both positive and negative) in the first subperiod, this number decreased to 14 coefficients in the second subperiod and further to 12 coefficients when changes are observed over the third subperiod 1978-79 to 1983-84. Another feature which can be observed from Table 6.2 is that decreases of coefficients were more common in the period 1968-69 to 1973-74 than in the latter two subperiods. The average change in coefficients was -9.7% in the first subperiod, 1% in the second subperiod and 3.3% in the third subperiod.

Table 6.2

Changes in the 100 Most Important Input-Output Coefficients Between 1968-69, 1973-74, 1978-79 and 1983-84.

Range of Changes in $\left[\frac{Aij(t) - Aij(o)}{Aij(o)}\right]$	Number of Coefficients		
	Between 1968-69 & 1973-74	Between 1973-74 & 1978-79	Between 1978-79 & 1983-84
< -1.0	4	0	2
-1.0 to -0.8	10	7	0
-0.8 to -0.6	4	9	2
-0.6 to -0.4	14	7	12
-0.4 to -0.2	15	17	21
-0.2 to 0	14	7	19
0 to 0.2	17	15	17
0.2 to 0.4	4	13	8
0.4 to 0.6	2	6	4
0.6 to 0.8	2	3	3
0.8 to 1.0	0	2	2
1.0 <	14	14	10
Total	100	100	100

Source : Same as Table 6.1

The next aspect of structural change in technology considered is to find out the industries having the most significant impacts on the output development of other industries. This has been done by counting the number of coefficients which a particular industry has among the 100 most important Input-Output coefficients of the years 1968-69, 1973-74, 1978-79 and 1983-84. As explained in the previous section the

rows and columns of industries have been considered separately.

The number of important row coefficients in the years 1968-69, 1973-74, 1978-79 and 1983-84 is presented in Table 6.3. This group of industries consists of industries producing Crops, Services, Construction and such basic products as Energy, Iron and Steel, Non Metallic Minerals and Chemicals. These are the industries which supply products to other industries which use them for producing their outputs. Any change in the coefficients of these supplying industries affects the output of the using industries significantly. Other industries have mostly four or five coefficients among the most important coefficients in 1968-69, 1973-74, 1978-79 and 1983-84.

Table 6.4 shows the industries with the most Input-Output coefficients among the 100 most important coefficients in columns. This group consists of Machinery, Chemicals, Minerals, Metals, Beverages, Tobacco Products and Sugar and other industries like Leather, Wood, Coal Tar Products and Cement. These are the industries whose production methods demand outputs of other industries in such a way that any change in the coefficients of these industries significantly affects the output of other industries from which they draw their inputs.

Before we conclude this section we wish to study the correlation between size of Input-Output coefficients and the size of changes in coefficients for the Indian economy over the period 1968-69 to 1983-84. For this we divided the 100 most important Input-Output coefficients into two groups as explained earlier : (1) the coefficients with a value less than 0.10 in the

Table 6.3

THE IMPORTANT INDUSTRIES (ROW WISE) OVER THE PERIOD 1968-69 TO 1983-84

Industries	Number Of Coefficients In 1968-69	1973-74	1978-79	1983-84	Total
Trade, Hotels & Restaurants (44)*	25	23	26	20	94
Other Services (46)	6	12	9	13	40
Construction (39)	10	5	3	2	20
Iron & Steel (31)	4	4	5	4	17
Cash Crops (2)	3	6	4	3	16
Animal Husbandry (5)	3	3	3	3	12
Other Crops (4)	2	3	3	3	11
Electricity, Gas, Water Supply (40)	3	2	2	3	10
Coal & Lignite (8)	3	2	2	2	9
Food Crops (1)	1	2	2	2	7
Pesticides, Drugs, Other Chemicals (28)	1	1	2	3	7
Non Metallic Minerals (30)	1	2	2	2	7
Railway Transport Services (41)	2	1	2	2	7
Other Transport Services, Storage & Warehousing (42)	2	1	2	2	7

* Shows sector number

Source : Same as Table 6.1

Table 6.4

THE IMPORTANT INDUSTRIES (COLUMN WISE) OVER THE PERIOD 1968-69 TO 1983-84

Industries	Number of Coefficients In 1968-69	1973-74	1978-79	1983-84	Total
Beverages (14)*	4	7	10	7	28
Iron Ore (10)	6	4	6	7	23
Coal Tar Products (24)	5	4	4	6	19
Tobacco Products (15)	3	4	5	5	17
Food and Textile Machinery (35)	5	4	4	4	17
Agricultural Machinery(34	3	3	4	4	14
Leather (21)	3	3	4	4	14
Paints, Varnishes and Lacquers (27)	3	3	3	4	13
Other Machinery (36)	4	3	4	2	13
Sugar (12)	2	4	3	3	12
Other Minerals (11)	3	4	2	2	11
Wool, Silk, Synthetic Textiles (17)	4	4	2	1	11
Cement (29)	3	3	2	3	11
Other Basic Metal Industry (32)	3	2	2	4	11
Basic Heavy Chemicals(25)	3	3	2	2	10
Fertilisers (26)	3	3	2	2	10
Wood (19)	3	2	2	3	10
Metal Products excl. Machinery (33)	2	2	3	3	10

* Shows Sector number.

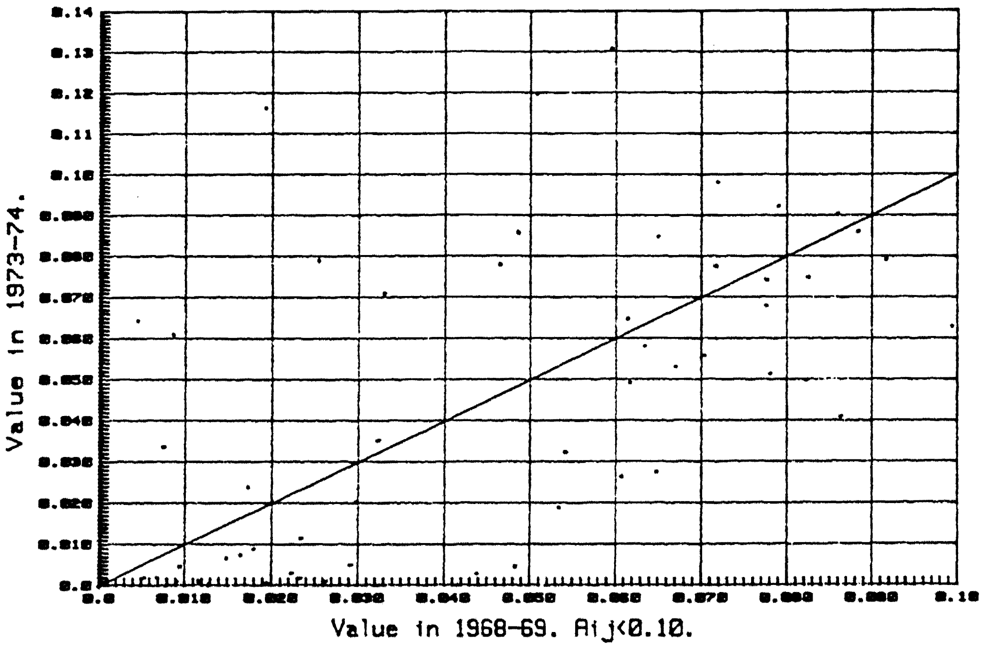
Source : Same as Table 6.3

base year and (2) the coefficients with a value more than 0.10 in the base year. Figures 6.1, 6.2 and 6.3 show the relationship of the small and large coefficients with their corresponding changes over the periods 1968-69 to 1973-74, 1973-74 to 1978-79 and 1978-79 to 1983-84 respectively. In the Figures 6.1, 6.2 and 6.3 the base year values are presented horizontally and values in comparison years vertically. The less the coefficients have changed, the more dense is the gathering of plots around the lines in the figures. In all the three subperiods under study the number of small coefficients (i.e. those less than 0.10 in the base year) are more than double the number of large coefficients (i.e. those more than 0.10 in the base year). The coefficients greater than 0.10 have a more dense distribution around the lines than the coefficients less than 0.10 in all three comparisons showing that smaller coefficients showed bigger changes as compared to the larger coefficients in India. This reflects that the group of smaller coefficients is as important as the other group of coefficients for the development of the Indian economy. In fact their role may even be bigger in the dynamics of the economy as breakthrough technological innovations are often related to them (Forssell, 1988a).

6.3 SUMMARY

In this chapter we examined the degree of changes in the most important Input-Output coefficients in the Indian economy. This issue was investigated in four exercises. In the first exercise the importance of a particular coefficient was determined by measuring the effects of changes in this

Fig 6.1. The 100 Most Sensitive Input-Output Coefficients, 1968-69 to 1973-74.



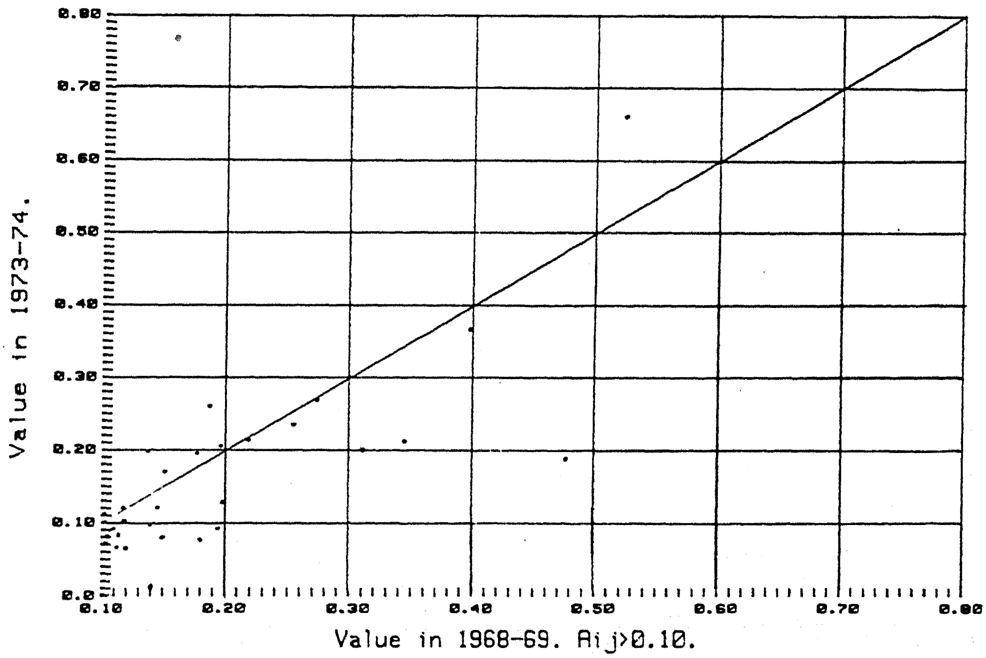
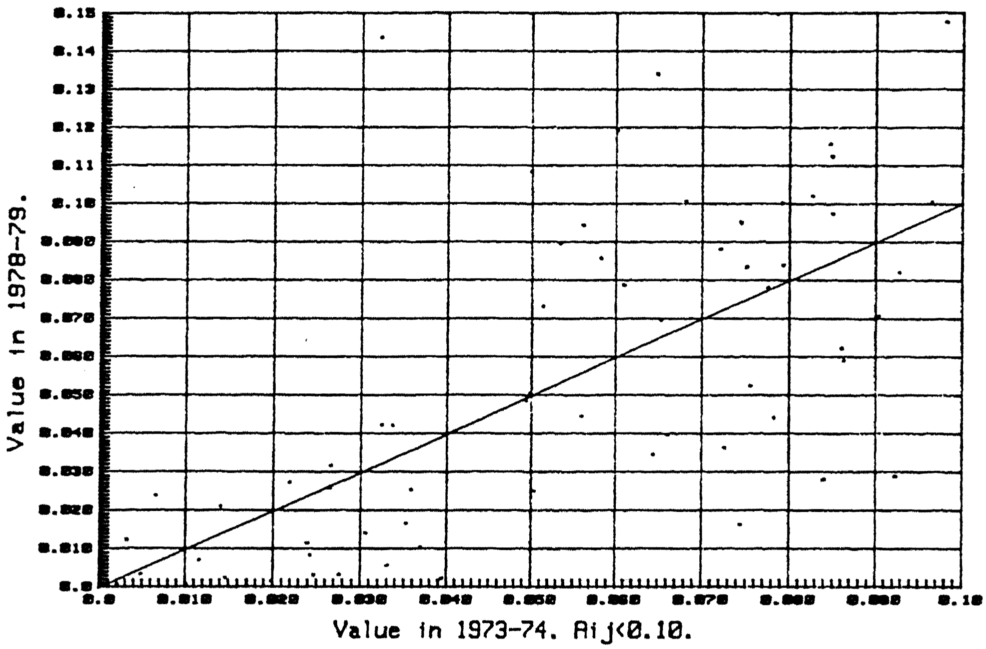


Fig 6.2. The 100 Most Sensitive Input-Output Coefficients, 1973-74 to 1978-79.



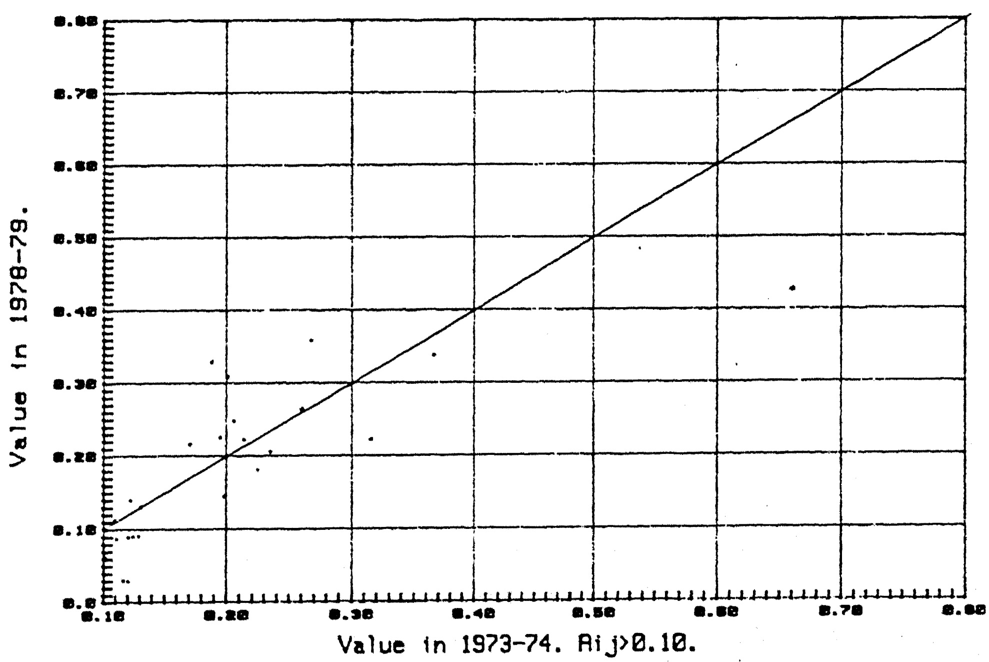
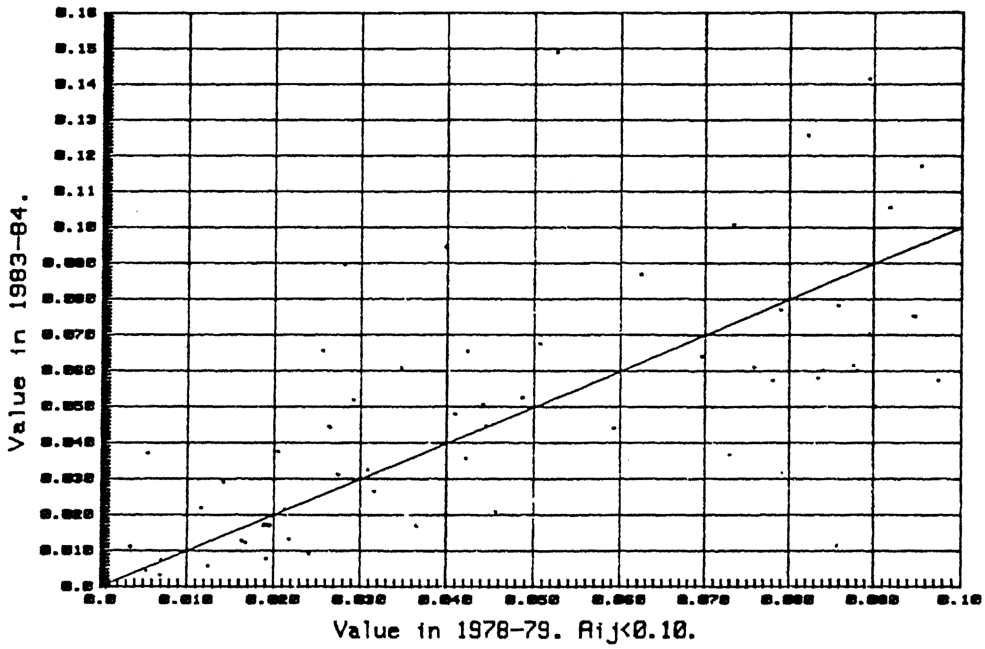
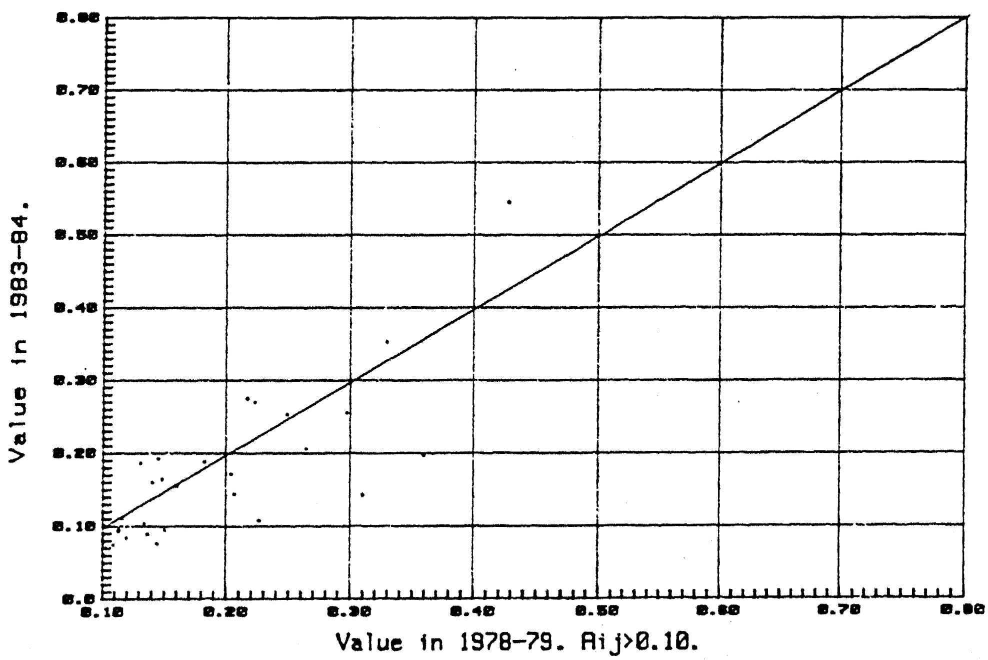


Fig 6.3. The 100 Most Sensitive Input-Output Coefficients, 1978-79 to 1983-84.





coefficient on the output of industries. The measure I_{ab} as given in equation (6.1) was used for measuring the importance of individual coefficients. The results showed that over the period 1968-69 to 1983-84, the number of coefficients increased in the ranges with the most important coefficients. On the other hand, the number of zero coefficents decreased reflecting the advancement of the Indian economy. The results also showed that a rather small group of Input-Output coefficients was important when the significance of their changes on development of the output of industries was considered.

The second exercise, therefore, involved an investigation of changes in the 100 most important Input-Output coefficients over the period 1968-69 to 1983-84. Results showed that there were 50 coefficients among the 100 most important coefficients which changed between 0 and 40% from 1968-69 to 1973-74. The number of coefficients in this range increased to 65 during 1978-79 to 1983-84. Input-Output coefficients changed more over the period 1968-69 to 1973-74 as compared to the latter two subperiods.

In the next exercise the 100 most important coefficients were used to find out the industries having the most significant impacts on the output development of other industries. The rows and columns of industries were considered separately. The group of industries with the maximum number of important row coefficients consisted of industries producing Crops (sectors 1, 2, 4), Services (41, 42, 44, 46) and such basic products as Energy (8, 40), Iron and Steel (31), Non Metallic Minerals (30), and Chemicals (28). On the other hand, the important column industries over the period 1968-69 to 1983-84 consisted of

Machinery (34, 35, 36), Chemicals (25, 26, 27), Minerals (10, 11), Metals (32, 33), Beverages (14), Tobacco Products (15), Sugar (12), Leather (21), Wood (19), Coal Tar Products (24) and Cement (29).

Finally the relationship between small coefficients and size of their changes and between large coefficients and size of their changes was investigated. Analysis showed that in all the subperiods under study the smaller coefficients changed more than the larger coefficients. All coefficients less than 0.10 in the base year were treated as small coefficients while all those more than 0.10 as large coeffcients. This indicates the importance of small coefficients in the technical development of the Indian economy.

The following chapter deals with structural changes in the Indian economy through an analysis of changes in employment.

CHAPTER 7

STRUCTURAL CHANGE : ANALYSIS OF CHANGE IN EMPLOYMENT

Since the First Five Year Plan achievement of full employment has been one of the objectives of planning in India. But the Indian Five Year Plans have failed to achieve the desired targets of employment. On the contrary, with each successful plan, unemployment as a percent of total labour force has been on the increase[1]. Also as explained in chapter 1 occupational structure has not kept pace with the changing NDP shares of the primary, secondary and tertiary sectors. While the share of the primary sector has significantly declined in the national income of India and those of the secondary and tertiary sectors significantly risen, there has been no clear shift in the workforce from the primary to the secondary and tertiary sectors of the country since 1951.

In light of the above it would be interesting to examine the detailed structure of employment in India over the period under study. The objective of this chapter is to investigate structural changes in the Indian economy over the period 1973-74 to 1983-84 by analysing changes in the employment structure of producing sectors and also by examining the sources of such change over the same period. This analysis has been restricted to the period 1973-74 to 1983-84 only on account of the nonavailability of

1. In 1977-78 unemployment (on the basis of usual status) was 4.23 percent of the labour force while in 1980 it rose to 4.48 percent of the total labour force (Datt and Sundharam, 1992).

authentic employment data for the sectors under study for the other two reference years, that is, 1968-69 and 1978-79 (the details of employment data problems are given in chapter 3, section 3.3).

This chapter has been divided into six sections. The methodology used in the analysis is presented in section 7.1. Section 7.2 discusses the structure of and changes in employment. The results of our analysis of the sources of employment growth and the detailed changes in the labour input coefficients for the Indian economy over the period 1973-74 to 1983-84 are presented and discussed in sections 7.3 and 7.4 respectively. Section 7.5 gives the results of the contribution of individual final demand categories to employment growth and finally section 7.6. gives a summary of the chapter.

7.1 METHODOLOGY

In this chapter we propose to analyse changes in the employment structure of the Indian economy over the period 1973-74 to 1983-84 and to decompose any employment changes over the same period into different categories of sources. We have used the 1973-74 and 1983-84 I-O tables (in 1983-84 prices) of the order (46 x 46) and the supplementary employment data collected from different sources for this purpose. The employment structure of any sector is defined as its sectoral share in total employment. The sources of growth in employment have been computed by a method which is an extention of the one used to compute the sources of output growth (as explained in chapter 5). How this has been done is explained in the following

subsection.

7.1.1 Sources of Employment Growth

Following the standard Input-Output model the level of labour can be described in terms of labour coefficients and the level of output. That is, the requirement of labour can be calculated as[1]

$$L = \hat{l} X \qquad - 7.1$$

where

L = a (n x 1) vector of labour requirements

$\hat{l}$ = a diagonal matrix of labour-output coefficients, expressed as the number required to produce a lakh rupees of sectoral gross output.

X = a (n x 1) vector of gross output

Just like output change described in chapter 5, the change in labour requirements can also be decomposed into the technology effect and the demand effect. The only difference is that in this case, the technology effect can further be decomposed into the effect due to changes in intermediate demand (intermediate demand effect) and to changes in the use of the labour input itself (labour input effect).

By using the same notations as in equations (5.1) to (5.6) in Table 5.1 of chapter 5, the framework for decomposing the change in employment into different sources between the initial year 0 and the terminal year t in the period to be analysed can be expressed as shown in Table 7.1. All variables in the model shown in Table 7.1 are measured in constant t year prices. $\hat{l}_0$ and

1. The details are given in chapter 2, section 2.1.3.

COMPONENTS OF CHANGE IN THE USE OF LABOUR

labour in the initial year	$L_o=\hat{l}_o.R_o\ [P_o+G_o+I_o+E_o-M_o]=\hat{l}_o.X_o$	- 7.
Change in employment due to average growth of final demand.	a) $\hat{l}_o.R_o.(g_P.P_o) = \hat{l}_o.dX(PL)$ b) $\hat{l}_o.R_o.(g_G.G_o) = \hat{l}_o.dX(GL)$ c) $\hat{l}_o.R_o.(g_I.I_o) = \hat{l}_o.dX(IL)$ d) $\hat{l}_o.R_o.(g_E.E_o) = \hat{l}_o.dX(EL)$ e) $-\hat{l}_o.R_o.(g_M.M_o) =-\hat{l}_o.dX(ML)$	- 7.
Change in employment due to change in the composition of final demand	a) $\hat{l}_o.R_o.[P_t-P_o-g_P.P_o]= \hat{l}_o.dX(PC)$ b) $\hat{l}_o.R_o.[G_t-G_o-g_G.G_o]= \hat{l}_o.dX(GC)$ c) $\hat{l}_o.R_o.[I_t-I_o-g_I.I_o]= \hat{l}_o.dX(IC)$ d) $\hat{l}_o.R_o.[E_t-E_o-g_E.E_o]= \hat{l}_o.dX(EC)$ e) $-\hat{l}_o.R_o.[M_t-M_o-g_M.M_o]=-\hat{l}_o.dX(MC)$	- 7.
Change in employment due to changes in intermediate output coefficients	a) $\hat{l}_o.[R_t-R_o].P_o = \hat{l}_o.dX(PT)$ b) $\hat{l}_o.[R_t-R_o].G_o = \hat{l}_o.dX(GT)$ c) $\hat{l}_o.[R_t-R_o].I_o = \hat{l}_o.dX(IT)$ d) $\hat{l}_o.[R_t-R_o].E_o = \hat{l}_o.dX(ET)$ e) $-\hat{l}_o.[R_t-R_o].M_o =-\hat{l}_o.dX(MT)$	- 7.
Change in employment due to changes in labour input coefficients	a) $[\hat{l}_t - \hat{l}_o]\ R_o.P_o$ b) $[\hat{l}_t - \hat{l}_o]\ R_o.G_o$ c) $[\hat{l}_t - \hat{l}_o]\ R_o.I_o$ d) $[\hat{l}_t - \hat{l}_o]\ R_o.E_o$ e) $-[\hat{l}_t - \hat{l}_o]\ R_o.M_o$	- 7.6
Change in employment due to interaction of final demand change & intermediate technology change	a) $\hat{l}_o.[R_t-R_o].[P_t-P_o] = \hat{l}_o.dX(PB)$ b) $\hat{l}_o.[R_t-R_o].[G_t-G_o] = \hat{l}_o.dX(GB)$ c) $\hat{l}_o.[R_t-R_o].[I_t-I_o] = \hat{l}_o.dX(IB)$ d) $\hat{l}_o.[R_t-R_o].[E_t-E_o] = \hat{l}_o.dX(EB)$ e) $-\hat{l}_o.[R_t-R_o].[M_t-M_o] =-\hat{l}_o.dX(MB)$	- 7.7
Change in employment due to interaction of labour input coefficient change & final demand change	a) $[\hat{l}_t-\hat{l}_o].R_o.[P_t-P_o]$ b) $[\hat{l}_t-\hat{l}_o].R_o.[G_t-G_o]$ c) $[\hat{l}_t-\hat{l}_o].R_o.[I_t-I_o]$ d) $[\hat{l}_t-\hat{l}_o].R_o.[E_t-E_o]$ e) $-[\hat{l}_t-\hat{l}_o].R_o.[M_t-M_o]$	- 7.8
Change in employment due to interaction of labour input coefficient change & intermediate technology change	a) $[\hat{l}_t-\hat{l}_o].[R_t-R_o].P_o$ b) $[\hat{l}_t-\hat{l}_o].[R_t-R_o].G_o$ c) $[\hat{l}_t-\hat{l}_o].[R_t-R_o].I_o$ d) $[\hat{l}_t-\hat{l}_o].[R_t-R_o].E_o$ e) $-[\hat{l}_t-\hat{l}_o].[R_t-R_o].M_o$	- 7.9
Change in employment due to interaction of labour input coefficient change, intermediate technology change and final demand change.	a) $[\hat{l}_t-\hat{l}_o].[R_t-R_o].[P_t-P_o]$ b) $[\hat{l}_t-\hat{l}_o].[R_t-R_o].[G_t-G_o]$ c) $[\hat{l}_t-\hat{l}_o].[R_t-R_o].[I_t-I_o]$ d) $[\hat{l}_t-\hat{l}_o].[R_t-R_o].[E_t-E_o]$ e) $-[\hat{l}_t-\hat{l}_o].[R_t-R_o].[M_t-M_o]$	- 7.10
labour in the terminal year	$L_t=\hat{l}_t.R_t.[P_t+G_t+I_t+E_t-M_t]=\hat{l}_t.X_t$	- 7.11

$\hat{l}_t$ are diagonal matrices of labour coefficients showing the number employed per lakh rupees of output in the initial year and the terminal year respectively. All other notations used in the above model are similar to those used in the case of output (chapter 5). However, for the sake of clarity we will repeat what the different symbols stand for. X_o, P_o, G_o, I_o, E_o and M_o are vectors of gross output, private consumption, government consumption, gross investment, exports and imports by industries, respectively, in the initial year o. R_o is the Leontief inverse matrix in the year o. X_t, P_t, G_t, I_t, E_t and R_t stand for corresponding matrices of the terminal year t. g_P, g_G, g_I, g_E and g_M represent the average growth rates of private consumption, government consumption, gross investment, exports and imports, respectively, between the initial and the terminal year. dX(PL) refers to the change in output which is due to average growth of private consumption category of final demand. Similarly, dX(GL), dX(IL), dX(EL) and dX(ML) are the change in output due to average growth of the other four categories of final demand. In the same way dX(PC), for example, refers to the change in output due to change in the composition of private consumption, while dX(GT) refers to that change in output which is due to change in intermediate technology and is attributed to government consumption category of final demand. Similarly dX(EB), for example, denotes that change in output which is due to the interaction effect of change in intermediate I-O coefficients and change in exports between the initial and the terminal year and is attributed to exports category of final demand.

Forssell's original model (1988b) of employment change

decomposed the change in employment into only four sources, that is, effects of average growth of final demand, effects of change in the composition of final demand, effects of change in intermediate I-O coefficients and effects of change in labour coefficients. As explained earlier in chapter 5, this he got by weighting the final demand change by the terminal year's technology (both intermediate and labour input technology) and the technological change by initial year's final demand and representing the total change in employment as the sum of these two changes. In measuring the total technology effect on employment, Forssell calculated the labour input effect according to the intermediate output of the initial year while he calculated the intermediate output effect according to the labour input use of the terminal year. As in the case of output change, an alternative formulation also suggested by Forssell (1988b) is to measure total employment change between the initial and the terminal year as the sum of final demand effect weighted by the initial year's technology and the technological effect weighted by the terminal year's final demand. In this case the labour input effect is calculated according to the intermediate output of the terminal year while the intermediate output effect is calculated according to the labour input use of the initial year. We prefer not to use either of Forssell's above mentioned formulations for reasons already explained in chapter 5. Corresponding to the formulation we adopted for studying changes in output, in the case of employment change also, our formulation uses initial year weights for both the final demand and

technological components of total employment change between year o and year t as shown in equations (7.3) to (7.10) in Table 7.1. In doing so four extra components emerge (equations 7.7, 7.8, 7.9 and 7.10 of Table 7.1) which will be interpreted with the four main components of total employment change below.

The use of labour is related to industrial output (equation 7.1). It is considered in each industry as a direct use related to production, which directly and indirectly serves some final demand category in the whole economy. Changes in the use of labour can be decomposed into four main effects : effects of average growth of final demand, of changes in the composition of final demand, of changes in intermediate output coefficients and in labour coefficients. The use of labour is distributed among private consumption, government consumption, gross investment, exports and imports within each of these four main components of employment change. The effects of imports should be interpreted as losses in the use of labour due to substitution of industry's domestic output by its imports.

The first component of employment change (equations 7.3 in Table 7.1) measures that employment change which is due only to the average growth of final demand categories between o year and t year keeping technology constant. The effects of average growth on the use of labour are analysed in order to reveal how much the use of industrial labour would have changed without changes in the composition of final demand categories and without changes in the input coefficients. Like in the case of output, this component is used as a base for comparison when differential growth rates between the final demand categories only (ignoring

sectoral growth variations within each final demand category) are taken into consideration.

The second component of employment change (equations 7.4 of Table 7.1) measures that employment change which is due to changes in the composition of final demand between the initial and the terminal year keeping technology constant. Its interpretation is also similar to the corresponding component of output change. That is, the effects of changes in the composition (or distribution) of final demand on the industrial use of labour are examined in order to describe how much changes in the use of labour are due to the deviations of final demand elements from the average growth of that particular final demand category.

The third component of employment change measures the effect of changes in intermediate I-O coefficients (equations 7.5 of Table 7.1) on employment while the fourth component (equations 7.6 of Table 7.1) measures the effect of changes in labour input coefficients themselves on employment. The effects of these two components are analysed in order to find out how much the use of labour has changed because of technical changes in the economy. These represent changes in the endogenous factors of the model. The intermediate Input-Output coefficients refer to rows of the industry (intermediate output) and the labour input coefficients to direct use of it in the industry.

The remaining four components of employment change (equations 7.7, 7.8, 7.9 and 7.10 of Table 7.1) appear as residuals because of the same set of weights (i.e. initial year) being used for the four main (i.e. final demand and technological

effect) components.

The fifth component of employment change (equations 7.7 of Table 7.1) measures the interaction effect of final demand change and intermediate technology change on employment change. This component shows the differential effect of final demand change due to intermediate technological change (or vice versa), on industrial employment.

The sixth component (equations 7.8 of Table 7.1) measures the interaction effect of labour coefficient change and final demand change on total employment change while the next component (equations 7.9 of Table 7.1) measures the interaction effect of labour coefficient change and intermediate technology change on employment change. The last component (equations 7.10 of Table 7.1) measures the interaction effect of three factors on employment change, that of labour coefficient change, intermediate technology change and final demand change on change in industrial employment. The effects of the four interaction factors are also distributed among the five final demand categories. Separating the four interaction components from the first four main components (equations 7.3, 7.4, 7.5 and 7.6) of employment change is important because if this is not done so, then the four main components are either overstated or understated on account of the interaction factors being included implicitly in them. Forssell's formulations suffer from this drawback. This has been explained in detail in Chapter 5.

7.1.2 Contribution of Final Demand Categories To Employment Change

As in the case of output, the aim is to measure the

contribution of separate demand factors like private consumption, government consumption, gross investment, exports and imports to employment change. The contribution of a particular final demand category can be measured by summing up the eight components of employment change (described in equations 7.3 to 7.10 of Table 7.1) attributable to that final demand category. This is similar to the identities implied in equations 5.11 in the case of output change described in Chapter 5.

7.2 EMPLOYMENT STRUCTURE

In this section we examine the structure of Indian labour employment for the years 1973-74 and 1983-84 while in the next section we decompose the change in employment structure into various sources of change. As already explained, sectoral employment structure refers to the percentage share of a sector's employment in the total employment of the Indian economy. Table 7.2 shows the sectoral structure of labour employment for 1973-74 and 1983-84. Also shown are their sectoral and overall growth rates during the period 1973-74 to 1983-84.

From Table 7.2 it can be seen that the pattern of change in labour employment is very similar to that observed for output (refer to Table 5.2, chapter 5). For example, the share of agriculture in total employment declined while the shares of the secondary and the tertiary sectors in total employment rose. The share of the primary sector (sectors 1 to 11) fell from 71.9% of the total employment in 1973-74 to 68.6% in 1983-84. On the other hand, the share of the secondary sector (sectors 12 to 40) in total employment rose from 11.4% in 1973-74 to 14.1% in 1983-84.

Table 7.2

INDIAN SECTORAL EMPLOYMENT STRUCTURE

Sector No.*	Employment Structure(%) 1973-74	Employment Structure(%) 1983-84	Average Annual Growth Rate (%) Between 1973-74 to 1983-84
1.	53.0	51.3	2.1
2.	15.7	13.8	1.2
3.	0.4	0.4	1.5
4.	0.4	0.4	2.2
5.	1.2	1.2	2.5
6.	0.2	0.2	6.3
7.	0.4	0.5	5.1
8.	0.3	0.4	5.6
9.	0.01	0.01	1.4
10.	0.1	0.04	-1.4
11.	0.2	0.3	5.2
12.	0.2	0.1	-2.1
13.	0.7	0.9	5.5
14.	0.1	0.1	-3.8
15.	0.6	0.8	4.3
16.	1.6	1.7	3.2
17.	0.2	0.2	5.2
18.	1.3	1.5	4.1
19.	1.0	1.1	2.7
20.	0.2	0.3	4.2
21.	0.3	0.2	-1.0
22.	0.1	0.1	7.6
23.	0.01	0.02	8.1
24.	0.01	0.01	-4.0
25.	0.03	0.03	3.2
26.	0.04	0.05	4.6
27.	0.02	0.03	5.2
28.	0.2	0.3	5.8
29.	0.1	0.1	-2.1
30.	0.7	0.8	3.9
31.	0.2	0.3	6.5
32.	0.03	0.04	4.4
33.	0.5	0.5	3.1
34.	0.03	0.1	9.8
35.	0.03	0.01	-11.1
36.	0.3	0.3	4.6
37.	0.2	0.2	5.6
38.	1.3	2.1	7.4
39.	1.4	1.8	5.5
40.	0.3	0.5	7.1
41.	0.6	0.6	3.7
42.	1.7	1.8	3.4
43.	0.3	0.4	5.4
44.	5.2	5.6	3.3
45.	0.3	0.5	7.1
46.	8.6	8.4	2.2
Total	100	100	2.5%

* For sector specifications see Table 3.1, Chapter 3.

The service sector (sectors 41 to 46) also showed a marginal increase in its share from 16.7% in 1973-74 to 17.3% of total employment in 1983-84. Within the primary sector, as in the case of output, Food Crops (sector 1) and Cash Crops (2) show a significant decline in their shares in total employment over the ten year period 1973-74 to 1983-84. Iron Ore (10) also shows a decline in its share over the same period. Fishing (7) and Coal and Lignite (8) show a marginal increase in their shares while the other primary sectors had similar shares from 1973-74 to 1983-84. The service sector shows a marginal increase in its share in total employment. All the service sectors show some increase in their shares. As in the case of output, Banking and Insurance (45) shows a significant increase in its share with a growth rate of 7.1% per annum over the ten year period under study. As mentioned earlier the share of the secondary sector in total employment also increased between 1973-74 and 1983-84. Within the secondary sector, sectors which showed negative growth rates and constant shares or a decline in their shares are Sugar (12), Beverages (14), Leather (21), Coal Tar Products (24), Cement (29) and Machinery for Food and Textile Industries (35). All other sectors within the secondary sector show positive growth rates (around 4%) and an increase in their shares in total employment over the same period. Rubber and Plastic Products (22), Petroleum Products (23), Iron and Steel Industries and Foundries (31), Agricultural Machinery (34), Transport Equipment and Miscellaneous Manufacturing (38) and Electricity, Gas and Water Supply (40) are the sectors with the highest growth rates

(around 7 to 8%) and with significant increases in their employment shares within the secondary sector. The sectoral growth rates reflect the changes in sectoral structures discussed above. Inspite of these similarities between employment change and output change there are some important differences, however, between the two. First, although the direction of employment change and output change is similar, the degrees of change between the two are very different. While total output increased at the approximate rate of 5% per annum, employment increased only at 2.5% per annum over the period 1973-74 to 1983-84. This reflects the mechanisation of the Indian economy as a result of which employment has risen at a much lower rate than output over the period under study. Second, the share of agriculture in employment is significantly larger than its share in output. In 1983-84 while the share of the primary sector in total employment was 68.6%, in total output it was only 28.4%. This is a clear indication of the prevalence of large scale disguised unemployment in agriculture and explains the low per capita labour productivity in agriculture and the widespread poverty.

7.3 SOURCES OF EMPLOYMENT GROWTH

The sources of growth in labour requirements are broken down into average growth of final demand, changes in the composition of final demand, changes in intermediate output coefficients, changes in labour coefficients and four interaction factors as explained in the methodology in section 7.1.1. Table 7.3 reports the breakdown of the sources of employment growth for the period 1973-74 to 1983-84. As in the case of output change, Table 7.3

shows the actual contribution (in lakh rupees) as well as the percentage share in total employment change, of the eight sources of change for each sector as well as for the total economy. The percentage figures across each row (rows show different sectors) sum to 100.

Table 7.3 shows that during the period 1973-74 to 1983-84 total employment increased by 27.5% of its initial level. During this period when total employment grew at 2.5% per annum (see Table 7.2), the major impetus to employment growth came from average growth of final demand due to which total employment increased by 57.6% of the initial level of 1973-74. On the other hand, change in employment due to change in the composition of final demand, due to changes in intermediate Input-Output coefficients and due to changes in labour coefficients were -18.3%, -0.16% and -5.1% of the level of 1973-74. That is, if the composition of final demand had not changed between 1973-74 and 1983-84 and neither had intermediate and labour coefficients changed, while the only change was that final demand grew at an average growth rate, then total employment would have increased by 57.6% of its initial level over the same period. Changes in the composition of final demand resulted in a decrease in employment levels by 18.3%. If we compare this with output change (chapter 5) over the same period we see that changes in the composition of final demand had a positive impact (about 2.5%) on output. This fact shows that while the structural changes initiated by government policies during this period led to an increase in production, it decreased employment considerably. This reflects the conflict between output and

Table 7.3 : SOURCES OF EMPLOYMENT CHANGE, 1973-74 TO 1983-84

Sector No**	Employment 1973-74 (Numbers)	Average Growth of F.D. effect (Numbers	Composition of F.D. Change effect (Numbers)	Intermediate Coefficient Change effect (Numbers)	Labour Coefft. Change effect (Numbers)	Interaction of F.D.Change & Intermediate Coefft. Change (Numbers)	Interaction of Labour Coefft. Change & F.D. Change (Numbers)	Interaction of Labour Coefft. Change & Intermediat Coefft. Change (Numbers)	Interaction of Labour Coefft. Change, Intermediate Coefft. Change & F.D Change (Numbers)	Total Change in Employment (Numbers)	Employment 1983-84 (Numbers)
1.	101283100	57924789	-3.7E+07	1209427	1799780	294511	365994	21491	-5233	23693293	124975800
		(244.5)*	(-157.5)	(5.1)	(7.6)	(-1.2)	(1.5)	(0.1)	(-0.02)	(100)	
2.	29944600	19263086	-4095463	-6488328	532099	-5527387	269514	-115291	-98216	3740011	33684910
		(515.1)	(-109.5)	(-173.5)	(14.2)	(-147.8)	(7.2)	(-3.1)	(-2.6)	(100)	
3.	835714	542135	-467357	-112442	353345	-113572	31616	-47540	-48018	138166	973942
		(392.4)	(-338.3)	(-81.4)	(255.7)	(-82.2)	(22.9)	(-34.4)	(-34.8)	(100)	
4.	779565	459734	-117576	-49870	-46479	-42867	-20402	2974	2556	188070	967543
		(244.4)	(-62.5)	(-26.5)	(-24.7)	(-22.8)	(-10.8)	(1.6)	(1.4)	(100)	
5.	2362781	1408391	703644	-50002	-707746	-111008	-632639	14978	33252	658868	3021646
		(213.8)	(106.8)	(-7.6)	(-107.4)	(-16.8)	(-96.0)	(2.3)	(5.0)	(100)	
6.	291950	177801	207784	-69492	-865	-68210	-1143	206	202	246284	538244
		(72.2)	(84.4)	(-28.2)	(-0.4)	(-27.7)	(-0.5)	(0.1)	(0.1)	(100)	
7.	676316	434037	-798	-196585	292992	-136372	187704	-85172	-59085	436720	1112973
		(99.4)	(-0.2)	(-45.0)	(67.1)	(-31.2)	(43.0)	(-19.5)	(-13.5)	(100)	
8.	527954	310040	-92227	170103	-53762	93151	-22169	-17313	-9481	378342	906612
		(81.9)	(-24.4)	(45.0)	(-14.2)	(24.6)	(-5.9)	(-4.6)	(-2.5)	(100)	
9.	20856	-42611	92475	25896	-16439	16500	-39292	-20405	-13001	3121	23985
		(-1365.2	(2962.8)	(829.7)	(-526.7)	(528.6)	(-1258.8)	(-653.8)	(-416.5)	(100)	
10.	102304	103203	-36711	-13921	-40707	-7377	-26453	5538	2935	-13493	88807
		(764.9)	(-272.1)	(-103.2)	(-301.7)	(-54.7)	(-196.0)	(41.0)	(21.8)	(-100)	
11.	394456	46375	340546	183083	-165898	160406	-162700	-76986	-67451	257374	651902
		(18.0)	(132.3)	(71.1)	(-64.5)	(62.3)	(-63.2)	(-29.9)	(-26.2)	(100)	
12.	426700	264113	205010	61682	-280072	49191	-307934	-40488	-32289	-80789	345881
		(326.9)	(253.8)	(76.3)	(-346.7)	(60.9)	(-381.2)	(-50.1)	(-40.0)	(-100)	
13.	1280100	858212	260338	-40984	-63292	-52844	-55305	2026	2613	910764	2190841
		(94.2)	(28.6)	(-4.5)	(-6.9)	(-5.8)	(-6.1)	(0.2)	(0.3)	(100)	
14.	212444	124953	257077	764	-161067	3539	-289684	-579	-2684	-67682	144704
		(184.6)	(379.8)	(1.1)	(-238.0)	(5.2)	(-428.0)	(-0.9)	(-4.0)	(-100)	
15.	1219242	714239	-349098	17521	192457	10034	57642	2766	1584	647145	1866154
		(110.4)	(-53.9)	(2.7)	(29.7)	(1.6)	(8.9)	(0.4)	(0.2)	(100)	
16.	3001879	1955663	276860	161272	-746704	85343	-555310	-40114	-21228	1115781	4117767
		(175.3)	(24.8)	(14.5)	(-66.9)	(7.6)	(-49.8)	(-3.6)	(-1.9)	(100)	
17.	319938	202109	524309	52282	-178659	107882	-405585	-29191	-60235	212912	532891
		(94.9)	(246.3)	(24.6)	(-83.9)	(50.7)	(-190.5)	(-13.7)	(-28.3)	(100)	
18.	2417567	1977625	474695	219925	-748961	131272	-759028	-68070	-40631	1186826	3606682
		(166.6)	(40.0)	(18.5)	(-63.1)	(11.1)	(-64.0)	(-5.7)	(-3.4)	(100)	
19.	1972499	1220963	-650537	199978	-188127	110706	-54402	-19072	-10558	608950	2581546
		(200.5)	(-106.8)	(32.8)	(-30.9)	(18.2)	(-8.9)	(-3.1)	(-1.7)	(100)	
20.	470750	267907	249544	-62734	-82803	-63795	-91011	11034	11220	239362	710166
		(111.9)	(104.3)	(-26.2)	(-34.6)	(-26.6)	(-38.0)	(4.6)	(4.7)	(100)	

Table 7.3 : SOURCES OF EMPLOYMENT CHANGE, 1973-74 TO 1983-84

Sector No**	Employment 1973-74 (Numbers)	Average Growth of F.D. effect (Numbers)	Composition of F.D. Change effect (Numbers)	Intermediate Coefficient Change effect (Numbers)	Labour Coefft. Change effect (Numbers)	Interaction of F.D.Change & Intermediate Coefft. Change (Numbers)	Interaction of Labour Coefft. Change & F.D. Change (Numbers)	Interaction of Labour Coefft. Change & Intermediat Coefft. Change (Numbers)	Interaction of Labour Coefft. Change, Intermediate Coefft. Change & F.D Change (Numbers)	Total Change in Employment (Numbers)	Employment 1983-84 (Numbers)
21.	522956	447998	-298861	293	-156671	3348	-44697	-88	-1003	-49683	473049
		(901.7)	(-601.5)	(0.6)	(-315.3)	(6.7)	(-90.0)	(-0.2)	(-2.0)	(-100)	
22.	162778	102032	95543	-26627	17771	-27803	21568	-2907	-3035	176543	339333
		(57.8)	(54.1)	(-15.1)	(10.1)	(-15.7)	(12.2)	(-1.6)	(-1.7)	(100)	
23.	20952	10658	-896	11882	-1621	6953	-755	-920	-538	24763	45715
		(43.0)	(-3.6)	(48.0)	(-6.5)	(28.1)	(-3.1)	(-3.7)	(-2.2)	(100)	
24.	22563	12396	-2698	-826	-11520	-636	-4953	422	325	-7491	15064
		(165.5)	(-36.0)	(-11.0)	(-153.8)	(-8.5)	(-66.1)	(5.6)	(4.3)	(-100)	
25.	60386	25275	36673	8246	-18464	-11627	-18939	-2521	3555	22198	82586
		(113.9)	(165.2)	(37.1)	(-83.2)	(-52.4)	(-85.3)	(-11.4)	(16.0)	(100)	
26.	72128	21979	-48009	192756	-43687	47151	15767	-116758	-28561	40637	112755
		(54.1)	(-118.1)	(474.3)	(-107.5)	(116.0)	(38.8)	(-287.3)	(-70.3)	(100)	
27.	38580	24410	263.4	6799	-3491	475	-2232	-615	-43	25565	64147
		(95.5)	(1.0)	(26.6)	(-13.7)	(1.9)	(-8.7)	(-2.4)	(-0.2)	(100)	
28.	352252	206678	221057	6078	-65345	-23637	-79345	-1128	4385	268744	621002
		(76.9)	(82.3)	(2.3)	(-24.3)	(-8.8)	(-29.5)	(-0.4)	(1.6)	(100)	
29.	193356	116829	-6826	43261	-112659	29504	-64090	-25205	-17190	-36376	156983
		(321.2)	(-18.8)	(118.9)	(-309.7)	(81.1)	(-176.2)	(-69.3)	(-47.3)	(-100)	
30.	1266485	751058	244293	-404345	192775	-252075	151506	-61547	-38370	583294	1849761
		(128.8)	(41.9)	(-69.3)	(33.0)	(-43.2)	(26.0)	(-10.6)	(-6.6)	(100)	
31.	371707	187570	19505	61456	10489	36150	5843	1734	1020	323768	695464
		(57.9)	(6.0)	(19.0)	(3.2)	(11.2)	(1.8)	(0.5)	(0.3)	(100)	
32.	57186	13481	46068	3345	-14224	-2588	-14813	-832	644	31082	88265
		(43.4)	(148.2)	(10.8)	(-45.8)	(-8.3)	(-47.7)	(-2.7)	(2.1)	(100)	
33.	922516	550995	34129	-221243	73294	-131252	46488	-17578	-10428	324403	1246949
		(169.8)	(10.5)	(-68.2)	(22.6)	(-40.5)	(14.3)	(-5.4)	(-3.2)	(100)	
34.	51893	29251	-29026	16834	43268	3315	188	14039	2765	80635	132503
		(36.3)	(-36.0)	(20.9)	(53.7)	(4.1)	(0.2)	(17.4)	(3.4)	(100)	
35.	66719	39592	-12105	-2710	-50443	-7340	-20781	2049	5549	-46189	20531
		(85.7)	(-26.2)	(-5.9)	(-109.2)	(-15.9)	(-45.0)	(4.4)	(12.0)	(-100)	
36.	496686	221718	130856	18732	-54099	7392	-38404	-2040	-805	283349	780031
		(78.2)	(46.2)	(6.6)	(-19.1)	(2.6)	(-13.6)	(-0.7)	(-0.3)	(100)	
37.	301457	167378	49506	26365	-21513	16413	-15477	-1881	-1171	219619	521079
		(76.2)	(22.5)	(12.0)	(-9.8)	(7.5)	(-7.0)	(-0.9)	(-0.5)	(100)	
38.	2547368	1575743	-300515	289740	591738	110347	296231	67305	25633	2656223	5203537
		(59.3)	(-11.3)	(10.9)	(22.3)	(4.2)	(11.2)	(2.5)	(1.0)	(100)	
39.	2584262	1547439	57250	132915	20374	65015	12651	1048	513	1837204	4421491
		(84.2)	(3.1)	(7.2)	(1.1)	(3.5)	(0.7)	(0.1)	(0.03)	(100)	
40.	630130	359166	46291	409856	-171871	273854	-110583	-111783	-74690	620238	1250411
		(57.9)	(7.5)	(66.1)	(-27.7)	(44.2)	(-17.8)	(-18.0)	(-12.0)	(100)	

Table 7.3 : SOURCES OF EMPLOYMENT CHANGE, 1973-74 TO 1983-84

Sector No**	Employment 1973-74 (Numbers)	Average Growth of F.D. effect (Numbers)	Composition of F.D. Change effect (Numbers)	Intermediate Coefficient Change effect (Numbers)	Labour Coefft. Change effect (Numbers)	Interaction of F.D. Change & Intermediate Coefft. Change (Numbers)	Interaction of Labour Coefft. Change & F.D. Change (Numbers)	Interaction of Labour Coefft. Change & Intermediat Coefft. Change (Numbers)	Interaction of Labour Coefft. Change, Intermediate Coefft. Change & F.D Change (Numbers)	Total Change in Employment (Numbers)	Employment 1983-84 (Numbers)
41.	1095131	675619 (140.2)	-84915 (-17.6)	87641 (18.2)	-138001 (-28.6)	30964 (6.4)	-74437 (-15.4)	-11044 (-2.3)	-3902 (-0.8)	481925 (100)	1577101
42.	3177744	2000940 (157.7)	398915 (31.4)	906064 (71.4)	-1164740 (-91.8)	536341 (42.3)	-879614 (-69.3)	-332097 (-26.2)	-196584 (-15.5)	1269223 (100)	4446964
43.	520989	308306 (86.0)	-32961 (-9.2)	168669 (47.0)	-96834 (-27.0)	115276 (32.2)	-51178 (-14.3)	-31350 (-8.7)	-21426 (-6.0)	358502 (100)	879589
44.	9860277	6147579 (161.6)	262232 (6.9)	586121 (15.4)	-1952150 (-51.3)	180831 (4.8)	-1269011 (-33.4)	-116039 (-3.1)	-35801 (-0.9)	3803761 (100)	13664110
45.	660800	387553 (59.5)	-44305 (-6.8)	284000 (43.6)	-64991 (-10.0)	167127 (25.7)	-33757 (-5.2)	-27930 (-4.3)	-16436 (-2.5)	651260 (100)	1312162
46.	16467106	9629135 (239.8)	3873375 (96.5)	1862125 (46.4)	-6232931 (-155.2)	1125328 (28.0)	-5110777 (-127.3)	-704825 (-17.6)	-425943 (-10.6)	4015487 (100)	20482600
TOT	191065100	1.1E+08 (216.9)	-3.5E+07 (-66.5)	-314999 (-0.6)	-9736461 (-18.6)	-3351095 (-6.4)	-9794195 (-18.7)	-1981704 (-3.8)	-1245286 (-2.4)	52458712 (100)	243526200
Tot Increase in Employment by		57.6%	-18.3%	-0.16%	-5.1%	-1.8%	-5.1%	-1.0%	-0.7%	27.5%	

* Figures in brackets show percentages.
** For Sector specifications see Table 3.1, Chapter 3.

Source : Same as Table 7.2

employment generation objectives of our Five Year Plans. Similarly while changes in intermediate Input-Output coefficients increased output over the same period, it led to a decrease in employment by -0.16% of its initial level of 1973-74. The decline in employment due to changes in labour coefficients was considerable by -5.1% of the initial level.

Besides these four main components, there are four interaction factors also affecting employment of the Indian economy over the period 1973-74 to 1983-84. Due to the interaction of final demand change and intermediate coefficient change, employment declined by 1.8% of its intial level, while the contribution of the interaction of labour coefficient change and final demand change was much larger at -5.1%. The contribution of the interaction of labour coefficient change and intermediate coefficient change on employment was -1.0% of its initial level while that of the interaction of labour coefficient change, intermediate coefficient change and final demand change was a marginal -0.7% over the same period. If we consider the four interaction factors together then we see that total employment decreased by 8.6% of its initial level between 1973-74 and 1983-84 due to them. That is, had these four interaction factors not been included as separate components, the four main components of employment change would have been understated by 8.6% of the 1973-74 level of employment.

Table 7.3 also gives the sectoral details underlying the aggregate changes explained above. In the period 1973-74 to 1983-84 we see from Table 7.3 that total employment declined in six

sectors in 1983-84 as compared to 1973-74, namely Iron Ore (10), Sugar (12), Beverages (14), Leather (21), Coal Tar Products (24) and Machinery for Food and Textile Industries (35). In all the other sectors total employment increased over the same period.

From Table 7.3 it can be seen that the average growth of final demand effect on employment change was positive for all sectors except Petroleum and Natural Gas (9). The average growth effect of each sector shows that assuming that interindustry relations and labour coefficients had not changed and neither had the composition (or distribution) of final demand changed, while the only change was that final demand grew at an average rate, then how much would have the total employment of each sector increased. But in actuality final demand of each sector grew at a rate different from the average growth rate. The impact of this is shown by changes in the composition of final demand effect. Changes in the composition of final demand shows how much each sector's actual final demand deviated from the final demand calculated according to the average growth rate and the effect of such deviation on employment of different sectors.* Table 7.3 shows that over the period 1973-74 to 1983-84, shifts in the composition of final demand decreased employment in sectors like Agriculture (sectors 1, 2, 3, 4), Coal and Lignite (8), Iron Ore (10), Tobacco Products (15), Wood (19), Leather (21), Coal Tar Products (24), Fertilisers (26), Cement (29), Agricultural Machinery (34), Machinery for Food and Textile Industries (35), Transport Equipment and Miscellaneous Manufacturing (38), Railway Transport Service (41), Communication (43) and Banking and Insurance (45). All other sectors showed an increase in

employment due to this effect over the same period chief among them being Animal Husbandry (5), Forestry (6), Petroleum, Natural Gas (9), Other Minerals (11), Food Products (12, 13), Beverages (14), Textiles (16, 17, 18), Paper (20), Rubber and Plastic Products (22), Chemicals (25, 27, 28), Other Non Metallic Minerals (30), Iron and Steel and Other Basic Metal Industry (31, 32), Metal Products (33), Machinery (36, 37), Construction (39), Electricity, Gas, Water (40) and Services (42, 44, 46). Overall we see that changes in the composition of final demand contributed -66.5% of the total employment change over the period 1973-74 to 1983-84, while average growth of final demand contributed 216.9% of the total employment change. That is, summing these two effects, the effect of final demand change was 150.4% of the total employment change.

Changes in intermediate Input-Output coefficients declined employment in sectors like Agriculture (2, 3, 4), Animal Husbandry, Forestry and Fishing (5, 6, 7), Iron Ore (10), Paper (20), Rubber and Plastic Products (22), Coal Tar Products (24), Non Metallic Minerals (30) and Metal Products (33). On the other hand, due to changes in intermediate Input-Output coefficients employment increased in sectors like Minerals (8, 9, 11), Sugar (12), Textiles (16, 17, 18), Wood (19), Petroleum Products (23), Chemicals (25, 26, 27, 28), Cement (29), Iron and Steel and Other Basic Metal Industry (31, 32), Machinery (34, 36, 37), Transport Equipment (38), Construction (39), Electricity, Gas, Water Supply (40) and all Services (41, 42, 43, 44, 45, 46). The overall contribution of this factor in total employment change during

1973-74 to 1983-84 was negligible at -0.6% of the total change.

The fourth important component of employment change is the labour coefficient change effect. From Table 7.3 it can be seen that the overall share of this factor in total employment change was -18.6% over the period under study. That is, of the total change in employment a decline of as much as 18.6% was because of change in labour coefficients themselves. Thus, the reductions in labour requirements due to the third (i.e. changes in intermediate Input-Output coefficients) and the fourth (i.e. changes in labour coefficients) components are mainly attributed to decreasing labour input coefficients, which can be associated with increasing labour productivity and increasing industrial specialization. Increased labour productivity and increased industrial specialization are closely related to one another for as an industry specializes, new technologies of production become available to this industry which, in turn, increases the productivity of its labour force (Guill, 1979, pp 174).

The sectoral details show that due to changes in labour input coefficients employment declined in 36 sectors. The decline was substantial in industries like Animal Husbandry (5), Minerals (8, 9, 10, 11), Sugar and Beverages (12, 14), Textiles (16, 17, 18), Leather (21), Coal Tar Products (24), Chemicals (25, 26, 27, 28), Cement (29), Food and Textiles Machinery (35) and Services (41, 42, 43, 44, 45, 46). Changes in labour coefficients increased employment only in the following sectors : Agriculture (1, 2, 3), Fishing (7), Tobacco Products (15), Rubber and Plastic Products (22), Non Metallic Minerals (30), Metal Products (33), Agricultural Machinery (34) and Transport Equipment and

Miscellaneous Manufacturing (38). A decline in employment of most sectors due to this factor reflects that production processes in India are becoming more capital intensive as a result of which the labour coefficients are declining.

The fifth component of employment change shows the effect of the interaction of final demand change and intermediate coefficient change on employment change. Over the period 1973-74 to 1983-84 this component constituted -6.4% of the total employment change.

The sixth component shows the interaction of labour coefficient change and final demand change and its effect on employment change. The share of this component in total employment change was quite substantial. It comprised -18.7% of the total employment change. This effect was negative for most sectors and was particularly high in sectors like Animal Husbandry (5), Crude Petroleum, Natural Gas (9), Iron Ore (10), Sugar (12), Beverages (14), Wool, Silk, Synthetic Fibre Textiles (17), Leather (21), Heavy Chemicals (25), Cement (29) and Other Services (46).

The seventh component which comprises -3.8% of the total employment change over the period 1973-74 to 1983-84 shows the effect of the interaction of labour coefficient change and intermediate coefficient change on total change in employment.

The last component shows the effect of the interaction of final demand change, labour coefficient change and intermediate coefficient change on the total change in employment over the period under study. From Table 7.3 we see that this factor

comprised -2.4% of the total employment change.

The four interaction components together make up -31.3% of the total employment change. If Forssell's formulations were used then these interaction components would appear implicitly in the first four main components of employment change. This would have resulted in significantly distorted figures of the main effects. However, by separating the interaction factors one gets the actual effects of the four main components.

7.4 CHANGING LABOUR INPUT COEFFICIENTS

One of the significant effects of the analysis presented in the preceding section was the marked reduction in labour inputs required to produce a given final demand due to changes in the labour input coefficients. This reduction in labour requirements was attributed to decreasing labour input coefficients and shifts in industrial specialization. In this section we shall investigate the changes in the labour input coefficients in the Indian economy over the period 1973-74 to 1983-84 in greater detail.

Table 7.4 presents information on the changes in the direct labour input coefficients in the Indian economy over the period 1973-74 to 1983-84. As the figures in this table show, decreasing labour coefficients characterized most of the sectors over the period under study. This reflects the trend of mechanisation of many production processes and the consequent increases in labour productivity in these production processes. The most significant decreases in labour coefficients were recorded in Crude Petroleum Natural Gas (9), Sugar (12), Beverages (14), Wool, Silk,

LABOUR INPUT COEFFICIENTS BY INDUSTRIES FOR
1973-74 AND 1983-84

Sector No.*	Labour Input Coefficients**		Average Annual Growth Rate (%) Between 1973-74 to 1983-84
	1973-74	1983-84	
1.	35.16	35.78	0.18
2.	35.16	35.78	0.18
3.	3.14	4.47	3.6
4.	0.48	0.45	-0.6
5.	2.16	1.51	-3.5
6.	1.22	1.21	-0.03
7.	4.96	7.11	3.7
8.	3.94	3.54	-1.1
9.	0.38	0.08	-14.4
10.	7.36	4.43	-4.9
11.	12.95	7.50	-5.3
12.	3.00	1.03	-10.1
13.	1.80	1.71	-0.5
14.	8.68	2.10	-13.2
15.	7.72	8.94	1.5
16.	5.42	4.07	-2.8
17.	2.00	0.88	-7.8
18.	10.47	7.23	-3.6
19.	12.47	11.28	-1.0
20.	2.42	1.99	-1.9
21.	4.81	3.37	-3.5
22.	0.99	1.10	1.04
23.	0.06	0.06	-0.8
24.	0.44	0.22	-6.9
25.	0.60	0.41	-3.6
26.	0.97	0.38	-8.9
27.	0.68	0.62	-0.9
28.	0.93	0.75	-2.03
29.	2.44	1.02	-8.4
30.	5.13	5.91	1.4
31.	0.76	0.78	0.3
32.	0.82	0.62	-2.8
33.	3.11	3.36	0.8
34.	0.85	1.56	6.3
35.	1.00	0.24	-13.2
36.	2.08	1.86	-1.1
37.	1.08	1.00	-0.7
38.	4.24	5.22	2.1
39.	1.71	1.73	0.08
40.	1.95	1.42	-3.1
41.	3.57	3.12	-1.3
42.	4.76	3.02	-4.5
43.	6.97	5.68	-2.0
44.	4.83	3.87	-2.2
45.	2.01	1.82	-1.03
46.	7.80	4.85	-4.6

* For Sector Specifications see Table 3.1, Chapter 3.

** Labour input coefficients show the number required for producing a lakh rupees of gross output of a particular sector.

Synthetic Fibre Textiles (17), Fertilisers (26), Cement (29) and Machinery for Food and Textile Industries (35), as can be seen from their negative growth rates in Table 7.4.

Of the 46 sectors, only 12 sectors experienced some increases in their coefficients over the period under study. These sectors are the following : Agriculture sectors (1, 2, 3), Fishing (7), Tobacco Products (15), Rubber and Plastic Products (22), Non Metallic Minerals (30), Iron and Steel (31), Metal Products excluding Machinery (33), Agricultural Machinery (34), Transport Equipment and Miscellaneous Manufacturing (38) and Construction (39). As can be seen from Table 7.4 the increase is significant in Plantation Crops (3), Fishing (7), Agricultural Machinery (34) and Transport Equipment (38). Sectors 3, 7 and 38 are still relatively more labour intensive than other sectors which is perhaps why they experienced some increase in their coefficients. From Table 7.4 we see that most increases occurred in the primary sector (i.e. 1, 2, 3, 7) and in sectors connected to agriculture (i.e. 34). Also, the other primary sectors recorded the lowest reductions in labour requirements (can be seen from their growth rates in Table 7.4) as compared to the other industrial groups over the period under study. Thus, the policies of the Indian government which were designed to increase the productivity of labour in the agricultural industries appears to have achieved very little success.

7.5 CONTRIBUTION OF FINAL DEMAND CATEGORIES TO EMPLOYMENT GROWTH

In section 7.3 the effect of changes in final demand on employment change was examined by grouping the five final demand

categories (PFCE, GFCE, GI, EXP and IMP) together under one head. In this section we wish to study the separate effects of changes in each component of final demand on employment change. Such a subdivision will help in analysing the effect of economic policies on employment growth by illustrating the different ways in which various government policies affect the individual components of final demand. This analysis is done by a method similar to the one used in the case of output (chapter 5) and as explained in section 7.1.2 of this chapter.

Table 7.5 shows the percentage contributions to changes in employment, of changes in PFCE, GFCE, GI, EXP and IMP for the period 1973-74 to 1983-84. In Table 7.5 the figures across each row sum to 100%.

During the period 1973-74 to 1983-84 employment grew at the rate of 2.5% a year (see Table 7.2). During this period the major impetus to employment growth came from increases in private consumption (PFCE) which recorded a contribution of 81.3% in total employment growth. Gross investment (GI) contributed 16.5% while the contributions from government consumption (GFCE), exports (EXP) and imports (IMP) were much smaller at 3.5%, 7.5% and -8.9% respectively. That is, consumption demand (both PFCE and GFCE) contributed a significant 84.8% of the total employment growth over the period under study.

A closer examination of Table 7.5 reveals the patterns associated with different sectors. The employment of sectors like Agriculture (1, 2, 3, 4), Animal Husbandry, Forestry and Fishing (5, 6, 7), Coal and Lignite (8), Food, Beverages and Tobacco (12, 13, 14, 15), Textiles (16, 17, 18), Paper (20), Petroleum

CONTRIBUTION OF FINAL DEMAND CATEGORIES TO EMPLOYMENT GROWTH BETWEEN 1973-74 TO 1983-84 (PERCENT)

Sector No.*	Private Consumption (PFCE)	Government Consumption (GFCE)	Gross Invest -ment (GI)	Exports (EXP)	Imports (IMP)	Total
1.	82.4	0.2	18.2	2.7	-3.5	100
2.	153.8	8.2	-57.2	-0.7	-4.1	100
3.	98.9	2.0	29.3	0.5	-30.7	100
4.	106.2	-2.8	-8.2	5.9	-1.1	100
5.	106.5	-1.4	-0.4	-1.9	-2.8	100
6.	107.9	1.9	-10.5	3.7	-2.9	100
7.	76.3	-1.9	-6.0	32.3	-0.6	100
8.	68.7	11.3	36.1	13.1	-29.1	100
9.	-1830.3	-210.0	-381.8	284.5	2237.6	100
10.	11.6	10.8	93.9	8.5	-24.8	100
11.	25.4	7.2	36.8	10.3	20.4	100
12.	60.6	3.6	41.8	-9.9	4.0	100
13.	110.7	0.1	5.5	-3.5	-12.8	100
14.	41.5	1.6	56.3	0.9	-0.3	100
15.	102.2	0.8	-5.4	2.6	-0.2	100
16.	102.2	5.5	-1.2	-4.7	-1.8	100
17.	92.8	-1.6	17.4	-2.4	-6.2	100
18.	90.2	6.6	-7.5	15.3	-4.6	100
19.	-0.8	15.1	88.7	-3.1	0.1	100
20.	95.9	13.5	22.3	16.4	-48.1	100
21.	12.8	6.4	28.4	47.3	5.1	100
22.	33.5	2.5	65.9	5.8	-7.7	100
23.	87.2	10.9	19.3	18.5	-35.9	100
24.	4.3	4.9	101.5	2.5	-13.3	100
25.	110.5	3.6	49.1	12.5	-75.6	100
26.	112.7	2.0	-89.4	3.5	71.1	100
27.	26.4	10.4	64.5	8.9	-10.3	100
28.	63.4	4.5	44.6	10.3	-22.8	100
29.	-20.7	1.9	79.9	-15.0	53.8	100
30.	86.5	5.8	11.5	127.3	-131.1	100
31.	34.3	10.3	86.6	10.0	-41.1	100
32.	42.5	7.7	54.6	9.3	-14.2	100
33.	104.6	-2.1	26.1	14.7	-43.3	100
34.	48.8	2.5	56.3	3.1	-10.7	100
35.	24.6	0.1	73.9	8.8	-7.4	100
36.	14.0	8.8	132.0	28.0	-82.8	100
37.	25.2	0.3	90.8	11.6	-27.9	100
38.	36.7	10.6	48.4	24.2	-19.9	100
39.	14.1	11.1	75.7	1.6	-2.5	100
40.	63.9	9.0	32.6	7.7	-13.1	100
41.	73.2	6.8	26.0	7.8	-13.8	100
42.	88.8	1.6	18.0	12.1	-20.5	100
43.	77.4	-1.8	26.2	12.9	-14.7	100
44.	84.5	0.5	13.4	9.7	-8.2	100
45.	64.6	17.1	20.4	11.7	-13.8	100
46.	70.2	9.5	16.3	14.5	-10.5	100
Total	81.3	3.5	16.5	7.5	-8.9	100

* For Sector Specifications see Table 3.1, Chapter 3

Products (23), Chemicals (25, 26, 28), Non Metallic Minerals (30) Other Basic Metal Industry (32), Metal Products and Agricultural Machinery (33, 34), Electricity, Gas, Water (40) and all Services (41 to 46) grew mostly because of increases in consumption (both PFCE and GFCE) demand. The share of government consumption within the consumption category for all these sectors is very small compared to the share of private consumption in total consumption demand. On the other hand, the employment growth of sectors like Iron Ore (10), Sugar (12), Beverages (14), Wood (19), Rubber and Plastic Products (22), Coal Tar Products (24), Chemicals (25, 27, 28), Cement (29), Iron and Steel and Other Basic Metal Industry (31, 32), Machinery (34, 35, 36, 37), Transport Equipment (38) and Construction (39) depended on increases in investment. Within these sectors, for sectors like Sugar (12), Beverages (14), Chemicals (25, 28), Other Basic Metal Industry (32) and Agricultural Machinery (34), both increases in consumption demand and increases in investment demand were important as can be seen from Table 7.5. The above results are similar to the trends observed in the case of output growth (chapter 5) and are consistent with the characteristics of different sectors.

Export demand was a relatively important source of employment growth in Crude Petroleum, Natural Gas (9), Leather (21) and Non Metallic Minerals (30) while decrease in imports led to the employment growth of Oil and Natural Gas (9) and Cement (29) sectors over the period 1973-74 to 1983-84. For the other sectors, imports led to a decrease in Indian employment as imports create employment opportunities in the country from which

India imports. Overall, the loss in employment due to imports (of -8.9%) was larger than the gain through Indian exports (of 7.5%).

7.6 SUMMARY

The objective of this chapter was to analyse changes in the employment structure of Indian sectors and also to examine the sources of such change over the period 1973-74 to 1983-84. This analysis was restricted to the period 1973-74 to 1983-84 on account of employment data problems. This chapter also examined the changes in the labour input coefficients of the different sectors in detail over the same period.

The changes in employment structure of different sectors were factored out into different sources viz., effects of average growth of final demand, effects of change in the composition of final demand, effects of change in intermediate I-O coefficients, effects of change in labour coefficients and effects of four interaction factors. Besides this, the contribution of individual final demand categories to employment growth were also analysed.

The results showed that the share of agriculture in total employment declined marginally while the shares of the secondary and tertiary sectors in total employment rose marginally during 1973-74 to 1983-84. The share of the primary sector in employment was significantly larger than its share in output indicating the prevalence of large scale disguised unemployment in agriculture. Overall, total employment grew at the rate of 2.5% per annum over this period.

The results of the sources of employment growth showed that over the period 1973-74 to 1983-84, changes in the distribution

of final demand resulted in a significant reduction in labour requirements. This result, when compared with the corresponding result of output change, indicates the conflict between output and employment generation objectives of our Five Year Plans. Technological change, which in reference to labour refers to both changes in the intermediate I-O coefficients and to changes in the direct labour coefficients, also resulted in a significant reduction in labour requirements which can be associated with increasing labour productivity.

The most significant factor resulting in an increase in the requirements of labour was the rising level of final demand. The average growth of final demand effect was sufficient to offset the labour saving effects of the other effects and to result in a net positive growth in total labour requirements.

The four interaction components together made up approximately -31% of the total employment change over the period 1973-74 to 1983-84. That is, the four main components of employment growth would have been understated by this large amount if the interaction components had not been factored out.

The results of detailed changes in labour input coefficients showed that decreasing direct labour input coefficients characterized most of the sectors over the period under study reflecting the trend of mechanisation of many production processes and the consequent increase in labour productivity in these production processes.

Finally, the analysis of different final demand categories showed that over the period 1973-74 to 1983-84, employment growth was largely attributable to changes in consumption demand (mainly

private consumption) followed by changes in investment demand. These results were similar to the trends observed in the case of output growth.

In the following chapter we take up the last aspect of structural change in India, that of changing cost shares of primary inputs.

CHAPTER 8

STRUCTURAL CHANGE : ANALYSIS OF CHANGE IN COST SHARES

In the preceding chapters three important parameters that is, output, technology and employment were taken up to measure structural change in India. In this chapter the parameter used to measure structural change is cost shares of primary inputs. As explained in chapter 2 (section 2.1.1), in the I-O framework primary inputs refer to those inputs (like labour, land and capital stock) whose production is not described in the I-O system.

The I-O model has been used in structural analysis by a number of economists like Carter (1970), Staglin and Wessels (1972), Forssell (1985) and others (for a detailed review, refer to chapter 2). These studies concentrated on the impact of changes in I-O coefficients and in final demand on the output of industries at constant prices. Analysis of changes in prices of primary inputs has been given considerably less attention. However, production for the needs of final demand, the use of primary inputs by industries in terms of constant prices and the role of the cost of using primary inputs in the formation of the cost of the production of final demand are each closely related to the other (Forssell, 1988b).

In this chapter we take up the third aspect for study, that is, changes in the cost shares of primary inputs and its impact on the prices of the output of different industries of the Indian

economy over the period 1968-69 to 1983-84. Studies like Forssell (1988b) have given the basic model in the I-O framework within which such analysis of cost shares can be conducted. There are very few studies, however, which have devoted themselves to an empirical study of this aspect. In this chapter we have used Forssell's (1988b) basic model, made some modifications to it and have used it to study cost share changes in the Indian economy.

This chapter has been divided into three sections. The methodology used in the analysis of cost share changes of primary inputs is presented in section 8.1. In section 8.2 the components of changes in cost shares of primary inputs for the Indian economy are identified, measured and explained. Finally section 8.3 presents an overview of this chapter.

8.1 METHODOLOGY

In this chapter we propose to analyse changes in costs or prices of outputs of industries of the Indian economy over the period 1968-69 to 1983-84 and to decompose any cost (or price) changes over the same period into different sources. We have used the four I-O tables (both in current and constant prices) of the years 1968-69, 1973-74, 1978-79 and 1983-84 for this purpose. For identifying and measuring the sources of cost change we have used Forssell's (1988b) technique with some modifications. The methodology is described in the following paragraphs.

Costs or prices are examined columnwise in the I-O framework. In chapter 2, the basic equation for determining the production costs or prices of the outputs of industries was explained as :

$$P' = v' [I-A]^{-1} \qquad - 8.1$$

where

P'= 1xn vector of prices per unit of output of industries,

v'= 1xn vector of primary input cost per unit of output of industries and

A = nxn matrix of I-O coefficients (measured in physical units)

Equation (8.1) shows that changes in output prices can result from changes in the matrix of technical coefficients A or changes in the per unit value added matrix v or due to changes in both, that is, A and v.

For the present study, changes in output prices are examined from the demand perspective. This perspective tells us the effect on output prices that result from changes in the demand of the products of one or more sectors. Suppose the final demand of the output of one or more sectors increases. To meet this increase in final demand, industries would have to increase their outputs which may be required either directly or indirectly to satisfy the increased final demand. At the next stage the increased production would affect the direct and indirect primary inputs required in the production of outputs needed to meet the change in final demand. Any change in the primary input prices or quantities (primary input and/or intermediate input quantities) or both resulting from this would affect the prices of the output of different industries. Thus, the right hand side (RHS) of equation (8.1) indicates how much each primary input in value terms is directly and indirectly included in one unit of final demand for each industry. In other words, it shows the cost

shares of primary inputs per unit of final demand. In this chapter we want to observe how much and in what direction these shares have changed between the initial and the terminal year under study for the Indian economy. If in equation (8.1) we denote $(I-A)^{-1}$ by R and v by UF, where U denotes the factor price component and F the quantity component of primary input use then the differences in cost shares (dCS) between the initial year (0) and terminal year (t) can be represented as follows:

$$dCS = U_tF_t.R_t - U_oF_o.R_o \qquad - 8.2$$

where

U_tF_t = 1xn matrix of primary input shares in the year t consisting of a price variable (U_t) and a quantity variable (F_t)

R_t = nxn Leontief inverse matrix of I-O coefficients in year t and

o,t = stand for the initial year and the terminal year, respectively.

These cost equations are given by the columns of the I-O tables. It can be seen from expression (8.1) that cost equations are the basis for analysing changes in prices.

Thus, dCS is a matrix of order (1xn) indicating the differences in the cost shares of primary inputs per unit of final demand between the initial and the terminal year. The columns of dCS refer to different industries. The differences in cost shares are mainly due to changes in the prices of primary inputs and to changes in primary and intermediate input technology.

Forssell decomposes the difference in cost shares of primary inputs per unit of final demand between the initial year and the

terminal year according to one of the following formulations:

$$dCS = U_tF_t.dR + U_tdF.R_o + dUF_o.R_o \quad \text{or} \qquad - 8.3$$

$$dCS = U_oF_o.dR + U_odF.R_t + dUF_t.R_t \qquad - 8.4$$

where the symbol d stands for change. For example dR implies change in the Leontief inverse matrix R. All other symbols are as explained earlier.

In the above two formulations the first two matrices on the right side refer to technical change. The first matrix concerns the intermediate input effect, indicating how much of the difference in cost shares (CS) is due to changes in intermediate inputs measured in constant prices. The second matrix on the right concerns the primary input effect, indicating how much of the difference is due to changes in the direct primary input coefficients measured in constant prices. The third matrix shows the price effect, showing how much of the change in CS is due to changes in the price of the primary inputs.

However, in this case also, Forssell's formulations (equations 8.3 and 8.4) suffer from two drawbacks as in the case of output and employment change. Firstly, the weights used for each of the three effects are different in equations (8.3) and (8.4) as a result of which a unique solution for each effect is not possible. Secondly in each formulation, one component is weighted by initial year values, one by terminal year values while mixed weights are used for the third component. For example, in equation (8.3) the intermediate input effect is weighted by value added coefficients (in value terms) of the

terminal year, the price effect is weighted by initial year primary input and intermediate input technology while the primary input effect is weighted by terminal year factor price and initial year intermediate input technology. As explained in earlier chapters any change between two periods should be weighted by initial year values as changes ought to be measured with respect to base year values. In view of these limitations, in the formulation that we have adopted all the three effects are weighted by initial year weights.

According to the methodology we have adopted for the purpose of this study (which is a modified version of Forssell's methodology) the components of changes in the cost shares of primary inputs between the initial year and the terminal year of the period under study are shown in Table 8.1.

Primary inputs for the purpose of our study include both labour costs and capital costs.

Input-Output tables both in current prices and in constant prices of year o and year t are required for calculating the different components of cost share change. In Table 8.1, U_o (1xn) refers to per unit factor price of primary inputs in year o while U_t (1xn) refers to the corresponding in year t. I-O tables give sectoral gross value added (in value terms) as a whole and do not give price variables and quantity variables of gross value added separately. Since prices of primary inputs by industries are not available the concept of relative prices was used and Uos and Uts were calculated as follows -

The factor prices of primary inputs for all industries in the year 1983-84 was assumed to be unity.

Table 8.1

COMPONENTS OF CHANGES IN THE COST SHARES OF PRIMARY INPUTS

Cost shares in the initial year	$U_o.\hat{F}_o.R_o$
a) effects of changes in primary input coefficients	$U_o.d\hat{F}.R_o$
b) effects of changes in intermediate input coefficients	$U_o.\hat{F}_o.dR$
c) effects of changes in average factor price of primary inputs	$U_g\ U_o.\hat{F}_o.R_o$
d) effects of structural changes in factor price of primary inputs	$U_t.\hat{F}_o.R_o-(U_o.\hat{F}_o.R_o+U_gU_o.\hat{F}_o.R_o)$
e) effects of interaction of factor price change and primary input coefficient change	$dU.d\hat{F}.R_o$
f) effects of interaction of factor price change and intermediate input coefficient change	$dU.\hat{F}_o.dR$
g) effects of interaction of primary input coefficient change and intermediate input coefficient change	$U_o.d\hat{F}.dR$
h) effects of interaction of factor price change, primary input coefficient change and intermediate input coefficient change.	$dU.d\hat{F}.dR$
Cost shares in the terminal year	$U_t.\hat{F}_t.R_t$

The factor prices for 1968-69, 1973-74 and 1978-79 were then calculated relative to the price (unity) of 1983-84. For example factor price for a particular industry of 1968-69 was calculated as follows -

$$U_{68-69i} = \frac{\text{value added of sector i of 1968-69 in 68-69 prices}}{\text{value added of sector i of 1968-69 in constant 1983-84 prices.}} \qquad - \ 8.5$$

where i stands for sector number.

In a similar manner the factor prices of the remaining years relative to 1983-84 prices were calculated. dU was calculated as $U_t - U_o$. U_g in Table 8.1 is a scalar indicating the average change in price of primary inputs between the terminal year and the initial year. It is calculated as :

$$U_g = \frac{\text{Sum } (U_{1t} F_{1o} + U_{2t} F_{2o} + \ldots + U_{nt} F_{no})}{\text{Sum } (U_{1o} F_{1o} + U_{2o} F_{2o} + \ldots + U_{no} F_{no})} - 1 \qquad - \ 8.6$$

That is,

$$U_g = \frac{\text{Sum of all value added of o year in t year prices}}{\text{Sum of all value added of o year in o year prices}} - 1 \qquad - \ 8.7$$

For example if o stands for 1973-74 and t stands for 1978-79 then per sector U_t is -

$$U_{78-79i} = \frac{\text{Sector i's value added in 1978-79 at 1978-79 prices}}{\text{Sector i's value added in 1978-79 at constant 1983-84 prices}} \qquad - \ 8.8$$

and per sector U_o is

$$U_{73-74i} = \frac{\text{Sector i's value added in 1973-74 at 1973-74 prices}}{\text{Sector i's value added in 1973-74 at constant 1983-84 prices}} \quad - \ 8.9$$

and in this case U_g between 1973-74 and 1978-79 is as follows -

$$U_g = \frac{\dfrac{\text{Sum of all value added of 1978-79 at 78-79 prices}}{\text{Sum of all value added of 1978-79 at 1983-84 prices}}}{\dfrac{\text{Sum of all value added of 1973-74 at 1973-74 prices}}{\text{Sum of all value added of 1973-74 at 1983-84 prices}}} - 1 \quad - \ 8.10$$

$\hat{F}_o$ and $\hat{F}_t$ in Table 8.1 denote diagonal matrices of quantitative primary input coefficients in year o and year t, respectively. Again since sectoral quantity primary input coefficients are not available the F_os and F_ts were calculated as follows -

The value added (in value terms) of 1968-69, 1973-74 and 1978-79 were first brought to constant prices of 1983-84. Since all four value added are now in the same constant prices they reflect the primary input figures in quantity terms. The Fs were then calculated by dividing the constant price value added of industries of a particular year by the constant price gross outputs of the corresponding industries of the same year. $d\hat{F}$ in Table 8.1 refers to $\hat{F}_t - \hat{F}_o$.

R_o and R_t in Table 8.1 refer to constant price Leontief inverse matrices for years o and t of order (nxn). The transaction matrices of all four years (i.e. 1968-69, 1973-74, 1978-79 and 1983-84) were first deflated to constant 1983-84 prices. Then the inverses of the four years were calculated. Since they are in constant prices each column of R shows

intermediate input requirements (in quantity terms) per unit of output of a particular year.

The first four components (a,b,c and d) in Table 8.1 show the main effects on cost share changes. They show the effects of changes in primary input coefficients, effects of changes in intermediate input coefficients, effects of changes in average factor price of primary inputs and effects of structural changes in factor price of primary inputs, on changes in cost shares of primary inputs between the initial year and the terminal year, respectively. Unlike Forssell's formulations, these four effects are weighted by initial year values showing the four separate effects with respect to the base year. But on doing this four more effects emerge (i.e.,e,f,g and h in Table 8.1) showing the effect of interaction factors on cost share change. In Forssell's formulations these interaction factors are implicitly included in the four main components thus either overstating or understating their values. By separating them (as in our formulation shown in Table 8.1) we have the advantage of knowing exactly the contribution or effect of a,b,c and d components on total cost share changes between the initial and the terminal year.

The effects of changes in the primary input coefficients (effect a) and in intermediate input coefficients (effect b) show to what extent technical development has changed cost shares. They are calculated in constant prices of 1983-84 as explained earlier. That is, they measure the effect of changes in quantities. The primary input effect (i.e. component a) indicates how much of the difference in cost share change is due to changes

in the direct primary input coefficients (in quantity terms) while the intermediate input effect (i.e. component b) indicates how much of the difference is due to changes in intermediate inputs (also in quantity terms). Both these technical effects are considered from the points of view of the processes of production (i.e. the columns of I-O tables).

The third component (c) in Table 8.1 shows the effects of changes in the average factor price of primary inputs on cost share changes between the initial year and the terminal year. This effect indicates how much cost shares would have changed if the factor price of primary inputs had changed equally in each industry and technology had remained unchanged. The effects are calculated using the technology of the initial year as shown in Table 8.1.

The fourth component of cost share change (d) shows the effects of structural changes in the factor price of primary inputs on cost share changes between the initial and the terminal year. The structural change in the price of primary inputs is the difference between the actual change and the average change of the price concerned. This effect indicates how much cost shares have changed owing to unequal development between the factor prices of primary inputs in different industries.

The remaining four components show the effects of interaction factors on cost share changes. The fifth component (e) shows the effects of interaction of factor price change and primary input coefficient change on cost share change. Component (f) shows the effects of interaction of factor price change and intermediate input coefficient change while component (g) gives

the interaction effect of primary input coefficient change and intermediate input coefficient change on changes in cost shares. The last component (h) shows the effects of interaction of factor price change, primary input coefficient change and intermediate input coefficient change on cost share change. The advantages associated with separating the interaction factors from the four main effects have already been explained. The effects of the four interaction factors on cost share changes are expected to be small as compared to the effects of the four main components. These will be investigated for the Indian economy in the following section.

A study of the different components of cost share change tells us how much increases in the prices of different commodities is due to a particular component. For example we can analyse how much rises in the prices of primary inputs (say) have contributed to increases in the prices of commodities.

The sum of the effects of the different components of change and cost shares in the initial year equals the cost shares in the terminal year.

The analysis of changes in cost shares, thus, gives information about the development of the production cost of industrial final demand. The cost elements of final demand are considered to be composed mainly of changes in the technology of using intermediate and primary inputs, and of changes in average and structural prices related to the use of primary inputs. Primary inputs are used in all the industries whose output is needed directly and indirectly for production of an element of

final demand. Primary inputs as we know are classified as value added in I-O tables.

In the next section we shall study changes in cost shares of primary inputs of different industries of the Indian economy over the period 1968-69 to 1983-84 and identify the sources of such change.

8.2 COMPONENTS OF CHANGES IN THE COST SHARES OF PRIMARY INPUTS

The components of changes in costs (or prices) of Indian industrial production are examined for the period 1968-69 to 1983-84. The entire period is divided into three subperiods and the analysis of changes in cost shares is conducted for the three subperiods 1968-69 to 1973-74, 1973-74 to 1978-79 and 1978-79 to 1983-84 as well as for the entire period that is, 1968-69 to 1983-84 under study. Breakdowns of the sources of cost share change for 1968-69 to 1973-74, for 1973-74 to 1978-79 and for 1978-79 to 1983-84 are shown in Tables 8.2, 8.3 and 8.4 respectively while Table 8.5 shows the different sources of cost share change for the total period 1968-69 to 1983-84. These tables show the actual contribution of the eight sources of change as well as their percentage contributions in total cost share change of sectors. The columns of these tables show sectors while the rows give the different components of cost share change. Cost shares for all years are shown relative to cost shares of 1983-84 (which is taken as unity). The percentage figures down each column in the four tables sum to 100. These tables also show the percentage change in total cost shares between the initial and the terminal year of the period under

study. This section begins by analysing the results for the 1968-69 to 1973-74 subperiod and then discusses the results for the other subperiods and for the total period also.

Table 8.2 gives the sources of cost share change for the 1968-69 to 1973-74 subperiod. During these years some sectors like Forestry and Logging (6), Oil and Gas (9), Sugar (12), Beverages (14) and Petroleum Products (23) experienced very high increases in the prices of their products. The cost (or price) of Oil and Gas increased by 235.7% in 1973-74 as compared to 1968-69 while that of Petroleum Products increased by 187.9% over the same period. On the other hand, sectors like Iron Ore (10), Rubber and Plastic Products (22), Fertilisers (26) and Railway Transport Service (41) experienced very small increases in their prices. The increase in Iron Ore and Railway Transport Service was only by 2% in 1973-74 as compared to 1968-69. For almost all the other sectors the increase in price over the same period was in the range of 20 to 60%. Overall we see that prices in the Indian economy increased by 47.4% in 1973-74 as compared to the prices of 1968-69.

For almost all sectors the major impetus to cost share increase came from effects of changes in average factor price of primary inputs (effect c). This component shows how much the cost shares of different sectors would have changed if the factor price of all sectors had increased by the average factor price and technology had remained unchanged. This effect is positive for all sectors. For some sectors the contribution of the average factor price change in total cost share change is very high. For example its contribution was 210% in Plantation Crops (3), 146%

Table 8.2 COMPONENTS OF CHANGES IN COST SHARES OF PRIMARY INPUTS BETWEEN 1968-69 AND 1973-74

Components \ Sectors	(1)**	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
$U_o.\hat{F}_o.R_o$	0.3160	0.3661	0.2380	0.2961	0.3195	0.1118	0.1816	0.1672	0.0542	0.3592	0.2914	0.3027
a) $U_o.\hat{dF}.R_o$	0.0146 (7.4)*	-0.0068 (-3.3)	-0.0060 (-10.2)	-0.0135 (-7.1)	-0.0252 (-12.3)	-0.0001 (-0.1)	-0.0008 (-0.6)	0.0019 (3.1)	0.0006 (0.5)	0.0126 (174.7)	0.0093 (4.8)	-0.0676 (-20.3)
b) $U_o.\hat{F}_o.dR$	-0.0127 (-6.5)	0.0050 (2.4)	0.0107 (18.2)	0.0151 (7.9)	0.0272 (13.3)	0.0005 (0.5)	0.0026 (2.0)	0.0026 (4.4)	0.0021 (1.6)	-0.0085 (-117.3	-0.0009 (-0.4)	0.0967 (29.1)
c) $U_g.U_o.\hat{F}_o.R_o$	0.1634 (83.0)	0.1893 (90.8)	0.1230 (209.9)	0.1531 (80.2)	0.1652 (80.8)	0.0578 (51.5)	0.0939 (72.8)	0.0864 (145.8)	0.0280 (21.9)	0.1857 (2568.5	0.1507 (76.9)	0.1565 (47.0)
d) $U_t.\hat{F}_o.R_o-U_o.\hat{F}_o.R_o-U_g.U_o.\hat{F}_o.R_o$	0.0344 (17.5)	0.0267 (12.8)	-0.0716 (-122.2	0.0397 (20.8)	0.0428 (21.0)	0.0540 (48.1)	0.0335 (26.0)	-0.0322 (-54.4)	0.0976 (76.5)	-0.1790 -2476.2	0.0359 (18.3)	1.2493 (375.4)
e) $dU.\hat{dF}.R_o$	0.0046 (2.3)	-0.0075 (-3.6)	-0.0034 (-5.8)	-0.0120 (-6.3)	-0.0208 (-10.2)	-0.0004 (-0.3)	-0.0014 (-1.1)	-0.0009 (-1.6)	-0.0020 (-1.5)	-0.0031 (-43.4)	0.0016 (0.8)	-1.1473 (-344.7
f) $dU.\hat{F}_o.dR$	-0.0053 (-2.7)	-0.0001 (-0.02)	0.0067 (11.5)	0.0095 (5.0)	0.0168 (8.2)	0.0003 (0.3)	0.0021 (1.6)	0.0013 (2.2)	0.0019 (1.5)	-0.0001 (-1.5)	-0.0028 (-1.4)	0.0326 (9.8)
g) $U_o.\hat{dF}.dR$	-0.0021 (-1.1)	0.0042 (2.0)	-0.0001 (-0.1)	-0.0003 (-0.2)	0.0002 (0.1)	0.0001 (0.1)	-0.0007 (-0.5)	0.0009 (1.5)	-0.0008 (-0.7)	-0.0005 (-6.6)	0.0030 (1.5)	0.0026 (0.8)
h) $dU.\hat{dF}.dR$	-0.0001 (-0.03)	-0.0024 (-1.1)	-0.0007 (-1.2)	-0.0006 (-0.3)	-0.0017 (-0.8)	-0.0001 (-0.1)	-0.0002 (-0.1)	-0.0007 (-1.1)	0.0003 (0.2)	0.0002 (2.2)	-0.0009 (-0.5)	0.0100 (3.0)
dCS	0.1968 (100)	0.2084 (100)	0.0586 (100)	0.1909 (100)	0.2044 (100)	0.1122 (100)	0.1290 (100)	0.0593 (100)	0.1276 (100)	0.0072 (100)	0.1959 (100)	0.3328 (100)
$U_t.\hat{F}_t.R_t$	0.5127	0.5745	0.2966	0.4871	0.5239	0.2240	0.3106	0.2265	0.1818	0.3664	0.4873	0.6355
$\frac{dCS}{U_o.\hat{F}_o.R_o} \times 100$	62.2%	56.9%	24.6%	64.4%	63.9%	100.3%	71.0%	35.4%	235.7%	2.0%	66.6%	109.8%

Table 8.2 COMPONENTS OF CHANGES IN COST SHARES OF PRIMARY INPUTS BETWEEN 1968-69 AND 1973-74

Components \ Sectors	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
$U_o.\hat{F}_o.R_o$	0.2858	0.2757	0.3192	0.3723	0.3581	0.3510	0.2638	0.2938	0.2546	0.2861	0.0677	0.1825
a) $U_o.d\hat{F}.R_o$	-0.0229 (-11.1)	-0.0217 (-8.2)	0.0228 (14.1)	0.0338 (19.1)	0.0369 (18.6)	-0.0067 (-5.9)	0.0520 (79.3)	0.0336 (33.1)	-0.0217 (-11.7)	0.0517 (114.9)	-0.0082 (-6.4)	0.0163 (17.2)
b) $U_o.\hat{F}_o.dR$	0.0412 (19.9)	0.0126 (4.7)	-0.0276 (-17.0)	-0.0176 (-9.9)	0.0091 (4.6)	0.0112 (9.9)	-0.0136 (-20.8)	-0.0148 (-14.6)	0.0335 (18.0)	-0.0269 (-59.8)	0.0121 (9.5)	-0.0036 (-3.7)
c) $U_g.U_o.\hat{F}_o.R_o$	0.1477 (71.5)	0.1425 (53.7)	0.1650 (101.8)	0.1925 (108.6)	0.1851 (93.2)	0.1815 (161.4)	0.1364 (208.0)	0.1519 (149.7)	0.1316 (70.8)	0.1479 (328.7)	0.0350 (27.4)	0.0943 (99.2)
d) $U_t.\hat{F}_o.R_o-U_o.\hat{F}_o.R_o-U_g.U_o.\hat{F}_o.R_o$	0.0594 (28.7)	0.3183 (119.9)	0.0053 (3.3)	-0.0295 (-16.6)	-0.0148 (-7.4)	-0.0767 (-68.2)	-0.0863 (-131.6	-0.0635 (-62.6)	0.0550 (29.6)	-0.1033 (-229.6	0.0899 (70.5)	-0.0272 (-28.6)
e) $dU.d\hat{F}.R_o$	-0.0477 (-23.1)	-0.2000 (-75.4)	0.0077 (4.8)	0.0063 (3.6)	-0.0230 (-11.6)	-0.0060 (-5.3)	-0.0065 (-9.9)	0.0008 (0.8)	-0.0265 (-14.3)	-0.0141 (-31.4)	-0.0187 (-14.7)	0.0063 (6.6)
f) $dU.\hat{F}_o.dR$	0.0237 (11.5)	-0.0999 (-37.6)	-0.0166 (-10.3)	-0.0025 (-0.7)	0.0042 (2.1)	0.0100 (8.9)	-0.0203 (-31.0)	-0.0067 (-6.6)	0.0125 (6.7)	-0.0137 (-30.5)	0.0175 (13.7)	0.0109 (11.4)
g) $U_o.d\hat{F}.dR$	0.0024 (1.1)	0.0149 (5.6)	0.0043 (2.6)	-0.0041 (-2.3)	-0.0006 (-0.3)	0.0017 (1.5)	0.0041 (6.2)	0.0004 (0.4)	0.0052 (2.8)	0.0081 (18.1)	0.0013 (1.0)	-0.0009 (-1.0)
h) $dU.d\hat{F}.dR$	0.0027 (1.3)	0.0989 (37.2)	0.0012 (0.8)	-0.0030 (-1.7)	0.0017 (0.9)	-0.0026 (-2.3)	-0.0002 (-0.2)	-0.0002 (-0.2)	-0.0037 (-2.0)	-0.0047 (-10.4)	-0.0013 (-1.0)	-0.0010 (-1.1)
dCS	0.2067 (100)	0.2654 (100)	0.1621 (100)	0.1773 (100)	0.1986 (100)	0.1124 (100)	0.0656 (100)	0.1015 (100)	0.1860 (100)	0.0450 (100)	0.1276 (100)	0.0951 (100)
$U_t.\hat{F}_t.R_t$	0.4924	0.5411	0.4814	0.5495	0.5567	0.4634	0.3294	0.3953	0.4406	0.3311	0.1953	0.2776
$\frac{dCS}{U_o.\hat{F}_o.R_o} \times 100$	72.0%	95.9%	50.7%	47.4%	55.5%	32.0%	24.7%	34.4%	72.9%	15.6%	187.9%	51.7%

Table 8.2 COMPONENTS OF CHANGES IN COST SHARES OF PRIMARY INPUTS BETWEEN 1968-69 AND 1973-74

Components \ Sectors	(25)	(26)	(27)	(28)	(29)	(30)	(31)	(32)	(33)	(34)	(35)	(36)
$U_o.\hat{F}_o.R_o$	0.2162	0.3495	0.2628	0.3549	0.2118	0.2397	0.2127	0.2215	0.2728	0.2571	0.2276	0.3157
a) $U_o.d\hat{F}.R_o$	-0.0008 (-0.9)	0.1259 (178.9)	0.0051 (3.8)	0.2180 (256.1)	0.0051 (9.7)	0.0564 (54.4)	-0.0110 (-8.5)	-0.0198 (-10.3)	-0.0015 (-1.2)	-0.0070 (-6.4)	-0.0559 (-45.6)	0.0111 (10.2)
b) $U_o.\hat{F}_o.dR$	0.0028 (2.8)	-0.0491 (-69.8)	0.0010 (0.8)	-0.0471 (-55.3)	0.0066 (12.6)	-0.0401 (-38.6)	0.0291 (22.6)	0.0454 (23.6)	0.0119 (10.1)	0.0170 (15.6)	0.0755 (61.7)	0.0034 (3.2)
c) $U_g.U_o.\hat{F}_o.R_o$	0.1118 (114.3)	0.1807 (256.8)	0.1359 (101.4)	0.1835 (215.5)	0.1095 (207.5)	0.1240 (119.5)	0.1100 (85.5)	0.1145 (59.6)	0.1410 (119.7)	0.1329 (121.9)	0.1177 (96.2)	0.1632 (150.0)
d) $U_t.\hat{F}_o.R_o-U_o.\hat{F}_o.R_o-$ $U_g.U_o.\hat{F}_o.R_o$	-0.0133 (-13.6)	-0.1327 (-188.6	0.0042 (3.1)	-0.1200 (-141.0	-0.0693 (-131.3	-0.0328 (-31.6)	0.0038 (3.0)	0.0614 (32.0)	-0.0273 (-23.2)	-0.0292 (-26.8)	-0.0077 (-6.3)	-0.0587 (-53.9)
e) $dU.d\hat{F}.R_o$	-0.0071 (-7.3)	-0.0376 (-53.4)	-0.0152 (-11.3)	-0.1239 (-145.4	-0.0026 (-4.9)	0.0157 (15.1)	-0.0110 (-8.6)	-0.0256 (-13.3)	-0.0069 (-5.9)	-0.0081 (-7.4)	-0.0355 (-29.0)	-0.0062 (-5.7)
f) $dU.\hat{F}_o.dR$	0.0009 (0.9)	-0.0133 (-18.9)	0.0002 (0.1)	-0.0415 (-48.8)	0.0035 (6.6)	-0.0181 (-17.4)	0.0088 (6.9)	0.0152 (7.9)	-0.0029 (-2.5)	0.0049 (4.5)	0.0405 (33.1)	-0.0008 (-0.7)
g) $U_o.d\hat{F}.dR$	0.0062 (6.3)	-0.0052 (-7.8)	0.0029 (2.2)	-0.0033 (-3.9)	0.0006 (1.2)	-0.0014 (-1.3)	0.0007 (0.6)	0.0020 (1.1)	0.0027 (2.3)	-0.0005 (-0.4)	-0.0068 (-5.5)	-0.0034 (-3.1)
h) $dU.d\hat{F}.dR$	-0.0025 (-2.5)	0.0017 (2.4)	-0.00 (-0.0)	0.0195 (22.9)	-0.0008 (-1.4)	-0.0001 (-0.01)	-0.0018 (-1.4)	-0.0011 (-0.6)	0.0009 (0.8)	-0.0009 (-0.8)	-0.0054 (-4.4)	0.0001 (0.1)
dCS	0.0978 (100)	0.0704 (100)	0.1341 (100)	0.0852 (100)	0.0528 (100)	0.1037 (100)	0.1287 (100)	0.1920 (100)	0.1178 (100)	0.1090 (100)	0.1224 (100)	0.1088 (100)
$U_t.\hat{F}_t.R_t$	0.3140	0.4199	0.3969	0.4401	0.2646	0.3434	0.3414	0.4136	0.3906	0.3661	0.3499	0.4245
$\frac{dCS}{U_o.\hat{F}_o.R_o} \times 100$	44.8%	19.9%	50.5%	23.9%	24.7%	43.0%	59.2%	80.8%	42.6%	42.0%	53.4%	34.1%

Table 8.2 COMPONENTS OF CHANGES IN COST SHARES OF PRIMARY INPUTS BETWEEN 1968-69 AND 1973-74

Components \ Sectors	(37)	(38)	(39)	(40)	(41)	(42)	(43)	(44)	(45)	(46)	TOTAL
$U_o.\hat{F}_o.R_o$	0.3749	0.3222	0.2557	0.2685	0.3581	0.3376	0.3699	0.2651	0.2504	0.3003	12.5590
a) $U_o.d\hat{F}.R_o$	0.1942 (175.5)	0.0031 (2.9)	0.0158 (11.4)	-0.0042 (-6.6)	0.0343 (334.6)	0.0052 (3.6)	0.0116 (9.7)	-0.0089 (-6.4)	0.0050 (3.5)	0.0205 (24.9)	0.6875 (11.6)
b) $U_o.\hat{F}_o.dR$	-0.0219 (-19.8)	0.0046 (4.4)	0.0008 (0.6)	0.0199 (31.0)	-0.0079 (-77.2)	0.0039 (2.6)	-0.0075 (-6.3)	0.0129 (9.2)	-0.0032 (-2.3)	-0.0079 (-9.6)	0.2060 (3.5)
c) $U_g.U_o.\hat{F}_o.R_o$	0.1938 (175.2)	0.1666 (159.1)	0.1322 (95.9)	0.1388 (216.3)	0.1852 (1809.0	0.1746 (118.5)	0.1913 (160.3)	0.1370 (98.1)	0.1295 (91.1)	0.1553 (188.6)	6.4934 (109.2)
d) $U_t.\hat{F}_o.R_o\ U_o.\hat{F}_o.R_o-$ $U_g.U_o.\hat{F}_o.R_o$	-0.1421 (-128.4	-0.0569 (-54.3)	-0.0113 (-8.2)	-0.0940 (-146.4	-0.1887 -1843.5	-0.0339 (-23.0)	-0.0706 (-59.1)	-0.0062 (-4.4)	0.0122 (8.6)	-0.0747 (-90.7)	0.3699 (6.2)
e) $dU.d\hat{F}.R_o$	-0.0930 (-84.0)	-0.0081 (-7.7)	0.0016 (1.1)	-0.0035 (-5.4)	-0.0101 (-98.7)	-0.0056 (-3.8)	-0.0021 (-1.7)	-0.0076 (-5.4)	0.0020 (1.4)	-0.0072 (-8.7)	-1.9114 (-32.1)
f) $dU.\hat{F}_o.dR$	-0.0276 (-24.9)	-0.0065 (-6.2)	0.0027 (2.0)	0.0047 (7.3)	-0.0010 (-10.1)	0.0001 (0.04)	-0.0017 (-1.4)	0.0192 (13.7)	-0.0032 (-2.2)	-0.0044 (-5.4)	-0.0371 (-0.6)
g) $U_o.d\hat{F}.dR$	0.0022 (2.0)	0.0020 (1.9)	-0.0007 (-0.5)	0.0055 (8.6)	-0.0018 (-17.4)	0.0026 (1.8)	-0.0036 (-3.1)	-0.0033 (-2.4)	0.00001 (0.01)	-0.0007 (-0.8)	0.0402 (0.7)
h) $dU.d\hat{F}.dR$	0.0049 (4.5)	-0.0003 (-0.03)	-0.0032 (-2.3)	-0.0031 (-4.8)	0.0004 (3.5)	0.0004 (0.3)	0.0019 (1.6)	-0.0034 (-2.5)	-0.0002 (-0.1)	0.0014 (1.7)	0.0999 (1.7)
dCS	0.1107 (100)	0.1047 (100)	0.1378 (100)	0.0642 (100)	0.0102 (100)	0.1473 (100)	0.1193 (100)	0.1397 (100)	0.1421 (100)	0.0823 (100)	5.9476 (100)
$U_t.\hat{F}_t.R_t$	0.4855	0.4269	0.3935	0.3327	0.3684	0.4849	0.4892	0.4047	0.3925	0.3826	
$\frac{dCS}{U_o.\hat{F}_o.R_o} \times 100$	29.0%	32.2%	53.7%	23.7%	2.8%	42.2%	32.2%	52.6%	56.7%	27.4%	47.4%

* Figures in brackets show percentages.

** For Sector Specifications see Table 3.1, Chapter 3.

Note : There may be some error in the results presented here on account of the 1968-69 table being in a commodity x industry form.

Source : Computed from the 46x46 sector I-O tables of 1968-69, 1973-74, 1978-79 and 1983-84 (in current as well as constant prices).

in Coal and Lignite (8), 2569% in Iron Ore (10), 161% in Jute, Hemp, Mesta, Other Textiles (18), 208% in Wood (19), 150% in Paper (20), 329% in Rubber and Plastic Products (22), 257% in Fertilisers (26), 216% in Pesticides, Drugs, Other Chemicals (28), 208% in Cement (29), 150% in Other Machinery (36), 175% in Electric, Electronic Machinery (37), 159% in Transport Equipment and Miscellaneous Manufacturing (38), 216% in Electricity, Gas, Water Supply (40), 1809% in Railway Transport Service (41), 160% in Communication (43) and 188.6% of total cost share change in Other Services (46). This shows that had the factor price increased by the average, cost shares in these sectors would have increased much more, by the amount listed above.

But actually the factor price of different sectors increased differently and not by the average. The effect of actual change in factor price on cost shares is shown by the structural change in factor price component (effect d). This effect shows the difference between the actual change in factor price and the average change in factor price for different sectors. This effect is positive for sectors whose actual factor price increase has been above the average and is negative for those sectors whose actual factor price increased below the average. All the sectors listed above in which the average factor price effect was very high are also the ones whose actual factor price grew below average over the period 1968-69 to 1973-74. When components (c) and (d) of cost share change are added we get the net impact of changes in factor price of primary inputs on total cost share change. For almost all sectors, (c) and (d) components together

contributed over 90% of the total cost share change. The only exceptions are Sugar (12) and Beverages (14) in which the contribution of (c) and (d) together was much higher and Railway Transport Service (41) in which the contribution of (c) and (d) together in total cost share change was negative. Overall the contribution of component (c), that is, average factor price change effect in the total cost share change of the Indian economy was 109% while the contribution of component (d) or the structural change in factor price effect was 6.2%.

The contribution of other components in total cost share change of sectors was much smaller as compared to the factor price change component. The effects of changes in primary input coefficients (effect a) was significant in a few sectors. Its contribution in total cost share change was 175% for Iron Ore (10), 79% in Wood (19), 115% in Rubber and Plastic Products (22), 179% in Fertilisers (26), 256% in Pesticides, Drugs and Other Chemicals (28), 175.5% in Electric, Electronic Machinery (37) and 335% in Railway Transport Service (41). This means that in these sectors the use of primary inputs (in quantity terms) has increased significantly (factor price and intermediate input technology remaining unchanged) on account of which cost shares in these sectors also increased significantly during 1968-69 to 1973-74. The contribution of this factor for the total economy was 11.6% of the total cost share change in India over the same period.

The effects of changes in intermediate input coefficients for the entire Indian economy was not very significant at 3.5% of the total cost share change in India over the period 1968-69 to

1973-74. For individual sectors we find the contribution of this component significant in sectors like Iron Ore (10) with a contribution of -117.3%, Rubber and Plastic Products (22) with -59.8%, Fertilisers (26) with -69.8%, Pesticides, Drugs and Other Chemicals (28) with -55.3%, Food and Textiles Machinery (35) with 61.7% and Railway Transport Service (41) where it contributed -77.2% in its total cost share change. In all sectors, except Food and Textiles Machinery (35), listed above the contribution of the intermediate input change effect is significantly negative showing that in these sectors quantitative intermediate input requirements have decreased (factor price and primary input technology remaining unchanged) due to which there has been a negative impact on the cost share change of these sectors during 1968-69 to 1973-74.

The effects of interaction of factor price change and primary input coefficient change (effect e) contributed -32.1% in the total cost share change of the Indian economy. On the other hand, the contribution of interaction of factor price change and intermediate input coefficient change (effect f), contribution of interaction of primary input coefficient change and intermediate input coefficient change (effect g) and the contribution of the interaction between factor price change, primary input coefficient change and intermediate input coefficient change (effect h) was insignificant for the Indian economy at -0.6%, 0.7% and 1.7% of India's total cost share change, respectively, during the first subperiod under study.

Analysing sectoral trends we see from Table 8.2 that the

contribution of the interaction effect of factor price change and primary input coefficient change (effect e) was significant in Sugar (12), Beverages (14), Pesticides, Drugs, Other Chemicals (28), Electric, Electronic Machinery (37) and in Railway Transport Service (41). The sectoral contributions of the other three interaction factors is in keeping with the overall trend observed for the entire economy that is, insignificant for almost all sectors of the Indian economy over the period 1968-69 to 1973-74.

The analysis of cost share change during the second subperiod 1973-74 to 1978-79 is shown in Table 8.3. During this period the overall price rise in the Indian economy was by 59% which was higher than the level of increase (47.4%) during the first subperiod. The contribution of the eight components in the total cost share change of the Indian economy during the second subperiod is as follows -

The effects of changes in primary input coefficients contributed 5.4% of the total change which was less than half of its corresponding level in the first subperiod. The contribution of effects of changes in intermediate input coefficients during 1973-74 to 1978-79 was 7.9% which was higher than the corresponding 3.5% level of 1968-69 to 1973-74 period. The effects of changes in average factor price of primary inputs contributed 73.2% of the total change during 1973-74 to 1978-79 which showed a significant decline from the corresponding level of the first subperiod. On the other hand, the contribution of effects of structural change in factor price increased significantly to 31.4% during 1973-74 to 1978-79 from the level

Table 8.3 COMPONENTS OF CHANGES IN COST SHARES OF PRIMARY INPUTS BETWEEN 1973-74 AND 1978-79

Components \ Sectors	(1)**	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
$U_o.\hat{F}_o.R_o$	0.5127	0.5743	0.2966	0.4871	0.5239	0.2240	0.3106	0.2265	0.1818	0.3664	0.4873	0.6355
a) $U_o.d\hat{F}.R_o$	-0.0564 (-42)*	-0.0149 (-27.4)	-0.0157 (-7.9)	-0.0128 (-14.4)	0.0638 (41.0)	-0.0075 (-5.3)	-0.0044 (-2.0)	-0.0164 (-9.9)	-0.0068 (-2.4)	-0.0135 (-4.1)	0.0156 (9.2)	1.1756 (785.9)
b) $U_o.\hat{F}_o.dR$	0.0488 (36.4)*	0.0089 (16.4)	0.0249 (12.5)	0.0101 (11.4)	-0.0605 (-38.9)	0.0161 (11.3)	0.0060 (2.8)	0.0321 (19.5)	0.0150 (5.4)	0.0151 (4.6)	-0.0110 (-6.5)	-0.1473 (-98.5)
c) $U_g.U_o.\hat{F}_o.R_o$	0.1822 (135.8)	0.2042 (375.6)	0.1054 (52.9)	0.1731 (195.9)	0.1862 (119.7)	0.0796 (55.8)	0.1104 (51.1)	0.0805 (48.8)	0.0646 (23.1)	0.1302 (39.3)	0.1732 (102.1)	0.2259 (151.0)
d) $U_t.\hat{F}_o.R_o-U_o.\hat{F}_o.R_o-U_g.U_o.\hat{F}_o.R_o$	-0.0416 (-31.0)	-0.1471 (-270.6	0.0832 (41.8)	-0.0851 (-96.3)	-0.0449 (-28.8)	0.0521 (36.5)	0.1051 (48.6)	0.0673 (40.8)	0.2112 (75.5)	0.2047 (61.8)	-0.0038 (-2.2)	-0.2644 (-176.7
e) $dU.d\hat{F}.R_o$	-0.0154 (-11.5)	-0.0025 (-4.6)	-0.0109 (-5.5)	-0.0029 (-3.3)	0.0177 (11.4)	-0.0045 (-3.1)	-0.0033 (-1.5)	-0.0114 (-6.9)	-0.0103 (-3.7)	-0.0130 (-3.9)	0.0024 (1.4)	-1.1245 (-751.7
f) $dU.\hat{F}_o.dR$	0.0243 (18.1)	0.0086 (15.8)	0.0072 (3.6)	0.0089 (10.1)	-0.0128 (-8.2)	0.0076 (5.3)	0.0027 (1.3)	0.0166 (10.1)	0.0064 (2.3)	0.0116 (3.5)	-0.0077 (-4.6)	-0.0174 (-11.6)
g) $U_o.d\hat{F}.dR$	-0.0046 (-3.4)	-0.0013 (-2.4)	0.0042 (2.1)	-0.0014 (-1.5)	0.0066 (4.2)	-0.0003 (-0.2)	0.0004 (0.2)	-0.0019 (-1.1)	-0.0002 (-0.1)	-0.0019 (-0.6)	0.0005 (0.3)	-0.0024 (-1.6)
h) $dU.d\hat{F}.dR$	-0.0033 (-2.5)	-0.0014 (-2.6)	0.0008 (0.4)	-0.0017 (-1.9)	-0.0005 (-0.3)	-0.0003 (-0.2)	-0.0007 (-0.3)	-0.0018 (-1.1)	-0.0002 (-0.1)	-0.0018 (-0.6)	0.0005 (0.3)	0.0049 (3.3)
dCS	0.1341 (100)	0.0544 (100)	0.1991 (100)	0.0883 (100)	0.1556 (100)	0.1427 (100)	0.2161 (100)	0.1651 (100)	0.2798 (100)	0.3314 (100)	0.1697 (100)	-0.1496 (-100)
$U_t.\hat{F}_t.R_t$	0.6469	0.6289	0.4957	0.5754	0.6795	0.3667	0.5268	0.3915	0.4616	0.6978	0.6570	0.4859
$\frac{dCS}{U_o.\hat{F}_o.R_o} \times 100$	26.1%	9.4%	67.1%	18.1%	29.7%	63.7%	69.5%	72.8%	153.5%	89.7%	34.7%	-23.5%

Table 8.3 COMPONENTS OF CHANGES IN COST SHARES OF PRIMARY INPUTS BETWEEN 1973-74 AND 1978-79

Components \ Sectors	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
$U_o.\hat{F}_o.R_o$	0.4924	0.5411	0.4814	0.5495	0.5567	0.4634	0.3294	0.3953	0.4406	0.3311	0.1953	0.2776
a) $U_o.d\hat{F}.R_o$	0.0374 (47.1)	0.0474 (22.6)	-0.1271 (-54.1)	-0.1084 (-58.1)	0.0677 (55.9)	0.0184 (9.5)	-0.0589 (-26.2)	-0.0250 (-12.1)	-0.0382 (-15.5)	-0.0345 (-14.2)	-0.0079 (-2.6)	-0.0378 (-20.9)
b) $U_o.\hat{F}_o.dR$	-0.0345 (-43.5)	0.0089 (4.2)	0.1142 (48.7)	0.0843 (45.1)	-0.0346 (-28.5)	-0.0199 (-10.2)	0.0573 (25.5)	0.0265 (12.9)	0.0263 (10.6)	0.0484 (19.9)	0.0250 (8.1)	0.0520 (28.7)
c) $U_g.U_o.\hat{F}_o.R_o$	0.1750 (220.3)	0.1923 (91.7)	0.1711 (72.9)	0.1953 (104.6)	0.1978 (163.2)	0.1647 (84.8)	0.1171 (52.2)	0.1405 (68.1)	0.1566 (63.4)	0.1176 (48.3)	0.0694 (22.6)	0.0987 (54.5)
d) $U_t.\hat{F}_o.R_o - U_o.\hat{F}_o.R_o - U_g.U_o.\hat{F}_o.R_o$	-0.0817 (-102.9	0.0361 (17.2)	0.1758 (74.9)	0.0686 (36.8)	-0.0754 (-62.2)	0.0323 (16.7)	0.1344 (59.9)	0.0683 (33.1)	0.1340 (54.2)	0.1256 (51.6)	0.2287 (74.6)	0.0848 (46.8)
e) $dU.d\hat{F}.R_o$	-0.0225 (-28.3)	-0.0899 (-42.8)	-0.1411 (-60.1)	-0.0831 (-44.5)	-0.0225 (-18.5)	0.0039 (2.0)	-0.0515 (-22.9)	-0.0164 (-7.9)	-0.0486 (-19.6)	-0.0328 (-13.5)	-0.0116 (-3.8)	-0.0332 (-18.3)
f) $dU.\hat{F}_o.dR$	-0.0055 (-6.9)	0.0142 (6.8)	0.0327 (13.9)	0.0645 (34.5)	0.0032 (2.7)	0.0111 (5.7)	0.0319 (14.2)	0.0149 (7.2)	0.0103 (4.2)	0.0242 (9.9)	0.0041 (1.3)	0.0224 (12.4)
g) $U_o.d\hat{F}.dR$	0.0821 (103.4)	0.0115 (5.5)	0.0039 (1.7)	-0.0183 (-9.8)	-0.0090 (-7.4)	-0.0103 (-5.3)	-0.0031 (-1.4)	0.0006 (0.3)	0.0062 (2.5)	-0.0016 (-0.6)	-0.0007 (-0.2)	-0.0033 (-1.8)
h) $dU.d\hat{F}.dR$	-0.0709 (-89.2)	-0.0108 (-5.1)	0.0052 (2.2)	-0.0162 (-8.7)	-0.0061 (-5.0)	-0.0060 (-3.1)	-0.0028 (-1.2)	-0.0031 (-1.5)	0.0005 (0.2)	-0.0035 (-1.4)	-0.0005 (-0.2)	-0.0026 (-1.4)
dCS	0.0794 (100)	0.2098 (100)	0.2347 (100)	0.1867 (100)	0.1212 (100)	0.1941 (100)	0.2244 (100)	0.2063 (100)	0.2471 (100)	0.2435 (100)	0.3065 (100)	0.1810 (100)
$U_t.\hat{F}_t.R_t$	0.5718	0.7509	0.7161	0.7362	0.6779	0.6575	0.5538	0.6016	0.6877	0.5745	0.5019	0.4586
$\frac{dCS}{U_o.\hat{F}_o.R_o} \times 100$	16.1%	38.7%	48.7%	33.9%	21.7%	41.8%	68.0%	52.0%	56.0%	73.2%	156.2%	64.9%

Table 8.3 COMPONENTS OF CHANGES IN COST SHARES OF PRIMARY INPUTS BETWEEN 1973-74 AND 1978-79

Components \ Sectors	(25)	(26)	(27)	(28)	(29)	(30)	(31)	(32)	(33)	(34)	(35)	(36)
$U_o.\hat{F}_o.R_o$	0.3140	0.4199	0.3969	0.4401	0.2646	0.3434	0.3414	0.4136	0.3906	0.3661	0.3499	0.4245
a) $U_o.d\hat{F}.R_o$	-0.0235 (-11.1)	-0.0642 (-27.3)	-0.0291 (-12.8)	-0.0395 (-18.4)	-0.0167 (-8.3)	-0.0007 (-2.7)	-0.0234 (-13.8)	0.0038 (1.7)	-0.0292 (-12.7)	-0.0766 (-29.1)	0.0468 (21.6)	-0.0109 (-5.7)
b) $U_o.\hat{F}_o.dR$	0.0322 (15.3)	0.0494 (21.0)	0.0335 (14.8)	0.0306 (14.2)	0.0401 (19.9)	0.0031 (1.2)	0.0236 (13.9)	0.0008 (0.3)	0.0250 (10.9)	0.0765 (29.1)	-0.0545 (-25.2)	0.0122 (6.3)
c) $U_g.U_o.\hat{F}_o.R_o$	0.1116 (53.0)	0.1492 (63.5)	0.1410 (62.3)	0.1564 (72.7)	0.0940 (46.7)	0.1221 (48.6)	0.1213 (71.5)	0.1470 (65.2)	0.1388 (57.9)	0.1301 (49.5)	0.1244 (57.4)	0.1508 (78.3)
d) $U_t.\hat{F}_o.R_o-U_o.\hat{F}_o.R_o-U_g.U_o.\hat{F}_o.R_o$	0.0992 (47.1)	0.1300 (55.3)	0.0958 (42.3)	0.0808 (37.6)	0.0902 (44.8)	0.1270 (50.6)	0.0509 (30.0)	0.0701 (31.1)	0.1046 (45.5)	0.1951 (74.2)	0.0891 (41.1)	0.0369 (19.2)
e) $dU.d\hat{F}.R_o$	-0.0209 (-9.9)	-0.0505 (-21.5)	-0.0211 (-9.3)	-0.0322 (-15.0)	-0.0187 (-9.3)	-0.0007 (-0.3)	-0.0139 (-8.2)	-0.0010 (-0.4)	-0.0209 (-9.1)	-0.0994 (-37.8)	0.0364 (16.8)	-0.0079 (-4.1)
f) $dU.\hat{F}_o.dR$	0.0173 (8.2)	0.0322 (13.7)	0.0114 (5.0)	0.0227 (10.6)	0.0191 (9.5)	0.0020 (0.8)	0.0150 (8.8)	0.0030 (1.3)	0.0122 (5.3)	0.0421 (16.0)	-0.0295 (-13.6)	0.0105 (5.5)
g) $U_o.d\hat{F}.dR$	-0.0013 (-0.6)	-0.0059 (-2.5)	-0.0011 (-0.5)	0.0061 (2.9)	-0.0039 (-1.9)	-0.0010 (-0.4)	-0.0021 (-1.2)	0.0017 (0.7)	-0.0002 (-0.1)	-0.0026 (-1.0)	0.0026 (1.2)	0.0010 (0.5)
h) $dU.d\hat{F}.dR$	-0.0040 (-1.9)	-0.0051 (-2.2)	-0.0041 (-1.8)	-0.0098 (-4.6)	-0.0027 (-1.4)	-0.0007 (-0.3)	-0.0016 (-0.9)	0.0001 (0.03)	-0.0007 (-0.3)	-0.0022 (-0.8)	0.0013 (0.6)	-0.0000 (-0.02)
dCS	0.2107 (100)	0.2351 (100)	0.2263 (100)	0.2150 (100)	0.2014 (100)	0.2511 (100)	0.1698 (100)	0.2254 (100)	0.2297 (100)	0.2630 (100)	0.2166 (100)	0.1927 (100)
$U_t.\hat{F}_t.R_t$	0.5247	0.6550	0.6232	0.6551	0.4660	0.5945	0.5112	0.6389	0.6203	0.6292	0.5665	0.6171
$\frac{dCS}{U_o.\hat{F}_o.R_o} \times 100$	66.6%	55.2%	56.7%	48.7%	75.7%	72.9%	49.5%	54.2%	58.6%	71.6%	61.7%	45.2%

Table 8.3 COMPONENTS OF CHANGES IN COST SHARES OF PRIMARY INPUTS BETWEEN 1973-74 AND 1978-79

Components \ Sectors	(37)	(38)	(39)	(40)	(41)	(42)	(43)	(44)	(45)	(46)	TOTAL
$U_o.\hat{F}_o.R_o$	0.4855	0.4269	0.3935	0.3327	0.3684	0.4849	0.4892	0.4047	0.3925	0.3826	15.1724
a) $U_o.d\hat{F}.R_o$	0.0132 (5.6)	-0.0169 (-7.6)	0.0039 (2.1)	-0.0314 (-10.6)	-0.0029 (-1.9)	-0.0107 (-4.8)	0.0047 (1.6)	-0.0282 (-20.0)	-0.0166 (-11.0)	-0.0038 (-1.7)	0.4879 (5.4)
b) $U_o.\hat{F}_o.dR$	-0.0025 (-1.0)	0.0159 (7.2)	0.0075 (4.1)	0.0327 (11.1)	0.0085 (5.7)	0.0063 (2.8)	0.0002 (0.1)	0.0370 (26.2)	0.0173 (11.4)	0.0027 (1.2)	0.7102 (7.9)
c) $U_g.U_o.\hat{F}_o.R_o$	0.1725 (73.1)	0.1517 (68.5)	0.1398 (75.5)	0.1102 (40.1)	0.1309 (87.2)	0.1723 (76.9)	0.1739 (57.9)	0.1438 (102.1)	0.1395 (91.9)	0.1360 (59.8)	6.5768 (73.2)
d) $U_t.\hat{F}_o.R_o - U_o.\hat{F}_o.R_o - U_g.U_o.\hat{F}_o.R_o$	0.0496 (21.0)	0.0689 (31.1)	0.0278 (15.0)	0.1879 (63.7)	0.0139 (9.3)	0.0560 (25.0)	0.1198 (40.0)	-0.0150 (-10.6)	0.0151 (10.0)	0.0950 (41.8)	2.8573 (31.4)
e) $dU.d\hat{F}.R_o$	-0.0001 (-0.03)	-0.0118 (-5.3)	-0.0018 (-0.9)	-0.0352 (-11.9)	-0.0035 (-2.3)	-0.0078 (-3.5)	0.0024 (7.9)	-0.0127 (-9.0)	-0.0067 (-4.4)	-0.0030 (-1.3)	-2.0577 (-22.9)
f) $dU.\hat{F}_o.dR$	0.0025 (1.1)	0.0114 (5.1)	0.0127 (6.9)	0.0299 (10.1)	0.0071 (4.7)	0.0075 (3.4)	-0.0013 (-0.4)	0.0227 (16.1)	0.0044 (2.9)	0.0005 (0.2)	0.5393 (6.0)
g) $U_o.d\hat{F}.dR$	0.0018 (0.7)	0.0020 (0.9)	-0.0022 (-1.2)	-0.0037 (-1.2)	-0.0023 (-1.6)	0.0008 (0.4)	0.0006 (0.2)	-0.0028 (-2.0)	-0.0009 (-0.6)	0.0004 (0.2)	0.0430 (0.5)
h) $dU.d\hat{F}.dR$	-0.0010 (-0.4)	0.0002 (0.1)	-0.0026 (-1.4)	-0.0035 (-1.2)	-0.0015 (-1.0)	-0.0006 (-0.2)	0.0002 (0.1)	-0.0040 (-2.8)	-0.0003 (-0.2)	-0.0005 (-0.2)	-0.1652 (-1.8)
dCS	0.2361 (100)	0.2214 (100)	0.1853 (100)	0.2950 (100)	0.1502 (100)	0.2240 (100)	0.3004 (100)	0.1409 (100)	0.1517 (100)	0.2273 (100)	8.9902 (100)
$U_t.\hat{F}_t.R_t$	0.7216	0.6483	0.5788	0.6276	0.5185	0.7089	0.7896	0.5456	0.5442	0.6099	
$\frac{dCS}{U_o.\hat{F}_o.R_o} \times 100$	48.5%	51.7%	46.9%	88.4%	40.5%	45.5%	61.3%	34.8%	38.6%	59.3%	59.0%

* Figures in brackets show percentages.
** For Sector specifications see Table 3.1, Chapter 3.

Source : Same as Table 8.2.

of 6.2% of 1968-69 to 1973-74.

The contribution of the interaction effect of factor price change and primary input coefficient change (effect e) showed a decline (in absolute terms) from -32.1% of the total cost share change during 1968-69 to 1973-74 subperiod to -22.9% during 1973-74 to 1978-79. The contribution of the interaction effect of factor price change and intermediate input coefficient change (effect f) was 6% during 1973-74 to 1978-79 which also showed an increase from the corresponding level of the first subperiod. Finally, the contribution of the last two interaction factors (effects g and h) during the second subperiod was insignificant and did not show much change from their levels during the first subperiod.

Coming next to sectoral details, from Table 8.3 we see that during 1973-74 to 1978-79 inflation was particularly high in Oil and Gas (9) and in Petroleum Products (23) though as compared to price rises in these sectors during 1968-69 to 1973-74, in the second subperiod their price rises were lower. On the other hand, Sugar (12) experienced a decrease in its price by 23.5% in 1978-79 as compared to 1973-74.

The contribution of the average factor price change (effect c) during 1973-74 to 1978-79 was 376% in Cash Crops (2), 196% in Other Crops (4), 151% in Sugar (12), 220% in Food Products excluding Sugar (13) and 163% of the total share change in Wool, Silk, Synthetic Textiles (17). In these sectors, on the other hand, the contribution of structural change in factor price effect (effect d) was significantly negative at -270.6% of the

total cost share change in Cash Crops (2), -96% in Other Crops (4), -177% in Sugar (12), -103% in Food Products excluding Sugar (13) and -62% in Wool, Silk, Synthetic Textiles (17). That is, in these sectors factor prices grew below the average factor price during 1973-74 to 1978-79 while the factor price of all the other sectors increased above the average. For the entire economy the net impact of factor price change (i.e. components (c) and (d) together) was 104.6% of the total cost share change of the Indian economy during 1973-74 to 1978-79. In all sectors this net impact was positive and over 90% of the sectoral cost share changes except in Sugar (12) in which (c) and (d) together contributed -25.7% of the cost share change of this sector.

Coming next to the sectoral details of the other components, from Table 8.3 it can be seen that the contribution of the effects of changes in primary input coefficients was very significant at 786% of the total cost share change in Sugar (12). The average of this component for all sectors comes out to be 5.4% for the entire economy during 1973-74 to 1978-79 as mentioned earlier. Again in Sugar (12) the contribution of changes in intermediate input coefficients is also very high at -98.5% of the total cost change in Sugar during the same period.

Overall the four interaction components contributed -18.2% of the total cost share change in the Indian economy over the period 1973-74 to 1978-79. The effect of interaction of factor price change and intermediate input coefficient change (effect f) is positive for almost all sectors. The interaction effect of factor price change and primary input coefficient change (effect

e) is very significant at -751.7% in Sugar (12). In Food Products excluding Sugar (13) the contributions of the interaction effect of primary input coefficient change and intermediate input coefficient change (effect g) and the interaction effect of primary input coefficient change, intermediate input coefficient change and factor price change (effect h) are significant and show variations from the overall trend of these components observed for the Indian economy. The contribution of the former is 103.4% while that of the latter is -89.2% of the total cost share change in sector 13. This shows that the four main components (a,b,c,d) would have been affected by -18.2% of the total cost share change of the Indian economy and much more in sectors like Sugar (12) and Food Products excluding Sugar (13) during 1973-74 to 1978-79 if Forssell's formulations had been used for decomposing the cost share changes.

The results of similar analysis conducted for the third subperiod 1978-79 to 1983-84 is shown in Table 8.4. Over this period of five years prices in the Indian economy were higher by 67.3% in 1983-84 as compared to 1978-79. This was higher than the levels of inflation observed in the earlier two subperiods. During this period the price of the product of Plantation Crops (3) increased signicantly by 102%, that of Forestry and Logging (6) by 173%, Coal and Lignite (8) by 155%, Oil and Gas (9) by 117%, Sugar (12) by 106%, Petroleum Products (23) by 99%, Coal Tar Products (24) by 118%, Cement (29) by 115%, Iron and Steel (31) by 96% and Railway Transport Service (41) by 93% in 1983-84 as compared to 1978-79. The increase in the prices of Oil and

Table 8.4 COMPONENTS OF CHANGES IN COST SHARES OF PRIMARY INPUTS BETWEEN 1978-79 AND 1983-84

Components \ Sectors	(1)**	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
$U_o.\hat{F}_o.R_o$	0.6469	0.6289	0.4957	0.5754	0.6795	0.3667	0.5268	0.3915	0.4616	0.6978	0.6570	0.4859
a) $U_o.d\hat{F}.R_o$	0.0103 (2.9)*	-0.0010 (-2.7)	-0.0088 (-1.7)	-0.0178 (-4.2)	-0.0201 (-6.3)	-0.0119 (-1.9)	-0.0021 (-0.4)	-0.0292 (-4.8)	-0.0116 (-2.1)	0.0257 (8.5)	-0.0185 (-5.4)	-0.0342 (-6.7)
b) $U_o.\hat{F}_o.dR$	-0.0035 (-1.0)	0.0150 (4.0)	0.0100 (2.0)	0.0228 (5.4)	0.0203 (6.3)	0.0212 (3.4)	0.0037 (0.8)	0.0568 (9.3)	0.0159 (3.0)	-0.0184 (-6.1)	0.0185 (5.4)	0.0876 (17.0)
c) $U_g.U_o.\hat{F}_o.R_o$	0.4060 (115.0)	0.3947 (106.4)	0.3111 (61.7)	0.3611 (85.0)	0.4264 (133.0)	0.2301 (36.3)	0.3306 (69.9)	0.2457 (40.4)	0.2897 (53.8)	0.4379 (144.9)	0.4123 (120.2)	0.3050 (59.3)
d) $U_t.\hat{F}_o.R_o - U_o.\hat{F}_o.R_o - U_g.U_o.\hat{F}_o.R_o$	-0.0529 (-15.0)	-0.0236 (-6.4)	0.1933 (38.3)	0.0635 (15.0)	-0.1059 (-33.0)	0.4032 (63.7)	0.1427 (30.1)	0.3628 (59.6)	0.2488 (46.2)	-0.1356 (-44.9)	-0.0693 (-20.2)	0.2091 (40.7)
e) $dU.d\hat{F}.R_o$	0.0017 (0.5)	-0.0091 (-2.4)	-0.0103 (-2.0)	-0.0159 (-3.7)	-0.0126 (-3.9)	-0.0241 (-3.8)	-0.0047 (-1.0)	-0.0637 (-10.5)	-0.0153 (-2.8)	0.0067 (2.2)	-0.0119 (-3.5)	-0.0985 (-19.2)
f) $dU.\hat{F}_o.dR$	-0.0098 (-2.8)	0.0022 (0.6)	0.0072 (1.4)	0.0104 (2.4)	0.0128 (4.0)	0.0143 (2.3)	0.0016 (0.3)	0.0363 (6.0)	0.0119 (2.2)	-0.0149 (-4.9)	0.0112 (3.3)	0.0453 (8.8)
g) $U_o.d\hat{F}.dR$	0.0013 (0.4)	0.0018 (0.5)	0.0019 (0.4)	0.0009 (0.2)	0.00002 (0.01)	0.0008 (0.1)	0.0011 (0.2)	0.0013 (0.2)	-0.0005 (-0.1)	0.0004 (0.1)	0.0010 (0.3)	0.0004 (0.1)
h) $dU.d\hat{F}.dR$	0.00001 (0.002)	0.00004 (0.01)	-0.0 (0.0)	-0.0003 (-0.1)	-0.0004 (-0.1)	-0.0003 (-0.04)	0.0005 (0.1)	-0.0015 (-0.2)	-0.0004 (-0.1)	0.0006 (0.2)	-0.0003 (-0.1)	-0.0006 (-0.1)
dCS	0.3531 (100)	0.3711 (100)	0.5043 (100)	0.4246 (100)	0.3205 (100)	0.6333 (100)	0.4732 (100)	0.6085 (100)	0.5384 (100)	0.3022 (100)	0.3430 (100)	0.5141 (100)
$U_t.\hat{F}_t.R_t$	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$\frac{dCS}{U_o.\hat{F}_o.R_o} \times 100$	54.6%	59.0%	101.7%	73.8%	47.2%	172.7%	89.8%	155.4%	116.7%	43.3%	52.2%	105.8%

Table 8.4 COMPONENTS OF CHANGES IN COST SHARES OF PRIMARY INPUTS BETWEEN 1978-79 AND 1983-84

Components \ Sectors	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
$U_o.\hat{F}_o.R_o$	0.5718	0.7509	0.7161	0.7362	0.6779	0.6575	0.5538	0.6016	0.6877	0.5745	0.5019	0.4586
a) $U_o.d\hat{F}.R_o$	-0.0365 (-8.5)	0.1198 (48.1)	0.1953 (68.8)	0.2710 (102.7)	0.0732 (22.7)	0.0759 (22.1)	-0.0648 (-14.5)	-0.0217 (-5.5)	0.0984 (31.5)	0.0399 (9.4)	0.0305 (6.1)	-0.0917 (-16.9)
b) $U_o.\hat{F}_o.dR$	0.0569 (13.3)	-0.0334 (-13.4)	-0.1135 (-40.0)	-0.1321 (-50.1)	-0.0340 (-10.6)	-0.0467 (-13.6)	0.0270 (6.0)	0.0372 (9.3)	-0.0682 (-21.8)	-0.0231 (-5.4)	-0.0127 (-2.6)	0.1390 (25.7)
c) $U_g.U_o.\hat{F}_o.R_o$	0.3589 (83.8)	0.4712 (189.1)	0.4494 (158.3)	0.4620 (175.1)	0.4255 (132.1)	0.4126 (120.5)	0.3476 (77.9)	0.3775 (94.8)	0.4316 (138.2)	0.3606 (84.7)	0.3150 (63.3)	0.2878 (53.2)
d) $U_t.\hat{F}_o.R_o-U_o.\hat{F}_o.R_o-U_g.U_o.\hat{F}_o.R_o$	0.0693 (16.2)	-0.2221 (-89.1)	-0.1654 (-58.3)	-0.1982 (-75.1)	-0.1034 (-32.1)	-0.0702 (-20.5)	0.0986 (22.1)	0.0209 (5.2)	-0.1194 (-38.2)	0.0649 (15.3)	0.1832 (36.8)	0.2536 (46.8)
e) $dU.d\hat{F}.R_o$	-0.0416 (-9.7)	-0.0555 (-22.3)	-0.0150 (-5.3)	-0.0525 (-19.9)	-0.0006 (-0.2)	0.0068 (2.0)	-0.0418 (-9.4)	-0.0217 (-5.4)	0.0036 (1.2)	0.0124 (2.9)	0.0032 (0.6)	-0.1434 (-26.5)
f) $dU.\hat{F}_o.dR$	0.0175 (4.1)	-0.0447 (-17.9)	-0.0876 (-30.9)	-0.0857 (-32.5)	-0.0420 (-13.0)	-0.0367 (-10.7)	0.0798 (17.9)	0.0070 (1.7)	-0.0541 (-17.3)	-0.0384 (-9.0)	-0.0252 (-5.1)	0.1120 (20.7)
g) $U_o.d\hat{F}.dR$	0.0011 (0.3)	0.0066 (2.6)	0.0180 (6.3)	-0.0066 (-2.5)	-0.0004 (-0.1)	-0.0030 (-0.9)	0.0013 (0.3)	-0.0003 (-0.1)	0.0146 (4.7)	0.0059 (1.4)	0.0028 (0.6)	-0.0050 (-0.9)
h) $dU.d\hat{F}.dR$	0.0025 (0.6)	0.0071 (2.9)	0.0027 (1.0)	0.0058 (2.2)	0.0039 (1.2)	0.0038 (1.1)	-0.0015 (-0.3)	-0.0005 (-0.1)	0.0056 (1.8)	0.0033 (0.8)	0.0014 (0.3)	-0.0108 (-2.0)
dCS	0.4282 (100)	0.2491 (100)	0.2839 (100)	0.2638 (100)	0.3221 (100)	0.3425 (100)	0.4462 (100)	0.3984 (100)	0.3123 (100)	0.4255 (100)	0.4981 (100)	0.5414 (100)
$U_t.\hat{F}_t.R_t$	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$\frac{dCS}{U_o.\hat{F}_o.R_o} \times 100$	74.9%	33.2%	39.7%	35.8%	47.5%	52.1%	80.6%	66.2%	45.4%	74.1%	99.3%	118.1%

Table 8.4 COMPONENTS OF CHANGES IN COST SHARES OF PRIMARY INPUTS BETWEEN 1978-79 AND 1983-84

Components \ Sectors	(25)	(26)	(27)	(28)	(29)	(30)	(31)	(32)	(33)	(34)	(35)	(36)
$U_o.\hat{F}_o.R_o$	0.5247	0.6550	0.6232	0.6551	0.4660	0.5945	0.5112	0.6389	0.6203	0.6292	0.5665	0.6171
a) $U_o.d\hat{F}.R_o$	-0.0525 (-11.1)	0.0392 (11.4)	0.0237 (6.3)	0.0830 (24.1)	-0.0208 (-3.9)	-0.1421 (-35.0)	-0.0521 (-10.7)	-0.0678 (-18.8)	0.0295 (7.8)	0.0984 (26.5)	-0.1395 (-32.2)	0.0345 (9.0)
b) $U_o.\hat{F}_o.dR$	0.0713 (15.0)	-0.0155 (-4.5)	-0.0029 (-0.8)	-0.0366 (-10.6)	0.0500 (9.4)	0.1392 (34.3)	0.0774 (15.8)	0.0628 (17.4)	-0.0091 (-2.4)	-0.0430 (-11.6)	0.1664 (38.4)	-0.0123 (-3.2)
c) $U_g.U_o.\hat{F}_o.R_o$	0.3293 (69.3)	0.4110 (119.1)	0.3911 (103.8)	0.4111 (119.2)	0.2924 (54.8)	0.3731 (92.0)	0.3208 (65.6)	0.4010 (111.1)	0.3893 (102.5)	0.3948 (106.5)	0.3555 (82.0)	0.3873 (101.2)
d) $U_t.\hat{F}_o.R_o-U_o.\hat{F}_o.R_o-U_g.U_o.\hat{F}_o.R_o$	0.1460 (30.7)	-0.0660 (-19.1)	-0.0143 (-3.8)	-0.0662 (-19.2)	0.2416 (45.2)	0.0324 (8.0)	0.1680 (34.4)	-0.0399 (-11.1)	-0.0095 (-2.5)	-0.0240 (-6.5)	0.0779 (18.0)	-0.0044 (-1.2)
e) $dU.d\hat{F}.R_o$	-0.0657 (-13.8)	-0.0148 (-4.3)	-0.0110 (-2.9)	-0.0069 (-2.0)	-0.0507 (-9.5)	-0.0959 (-23.7)	-0.0705 (-14.4)	-0.0385 (-10.7)	-0.0121 (-3.2)	-0.0216 (-5.8)	-0.1122 (-25.9)	-0.0081 (-2.1)
f) $dU.\hat{F}_o.dR$	0.0505 (10.6)	-0.0184 (-5.3)	-0.0280 (-7.4)	-0.0555 (-16.1)	0.0243 (4.6)	0.1115 (27.5)	0.0556 (11.4)	0.0376 (10.4)	-0.0149 (-3.9)	-0.0647 (-17.5)	0.1165 (26.9)	-0.0234 (-6.1)
g) $U_o.d\hat{F}.dR$	-0.0010 (-0.2)	0.0065 (1.9)	0.0111 (2.9)	0.0109 (3.2)	-0.0017 (-0.3)	-0.0047 (-1.2)	-0.0044 (-0.9)	0.0049 (1.4)	0.0037 (1.0)	0.0188 (5.1)	-0.0150 (-3.4)	0.0050 (1.3)
h) $dU.d\hat{F}.dR$	-0.0026 (-0.6)	0.0030 (0.9)	0.0072 (1.9)	0.0052 (1.5)	-0.0011 (-0.2)	-0.0079 (-1.9)	-0.0059 (-1.2)	0.0011 (0.3)	0.0028 (0.7)	0.0121 (3.3)	-0.0162 (-3.7)	0.0043 (1.1)
dCS	0.4753 (100)	0.3450 (100)	0.3768 (100)	0.3449 (100)	0.5340 (100)	0.4055 (100)	0.4888 (100)	0.3611 (100)	0.3797 (100)	0.3708 (100)	0.4335 (100)	0.3829 (100)
$U_t.\hat{F}_t.R_t$	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$\frac{dCS}{U_o.\hat{F}_o.R_o} \times 100$	90.6%	52.7%	60.5%	52.7%	114.6%	68.2%	95.6%	56.5%	61.2%	58.9%	76.5%	62.0%

Table 8.4 COMPONENTS OF CHANGES IN COST SHARES OF PRIMARY INPUTS BETWEEN 1978-79 AND 1983-84

Components / Sectors	(37)	(38)	(39)	(40)	(41)	(42)	(43)	(44)	(45)	(46)	TOTAL
$U_o.\hat{F}_o.R_o$	0.7216	0.6483	0.5788	0.6276	0.5185	0.7089	0.7896	0.5456	0.5442	0.6099	27.4968
a) $U_o.d\hat{F}.R_o$	0.1965 (70.6)	0.1072 (30.5)	-0.0197 (-4.7)	-0.0389 (-10.4)	-0.0309 (-6.4)	0.0309 (10.6)	0.0082 (3.9)	-0.0148 (-3.3)	-0.0107 (-2.3)	-0.0186 (-4.8)	0.6036 (3.3)
b) $U_o.\hat{F}_o.dR$	-0.0930 (-33.4)	-0.0675 (-19.2)	0.0188 (4.5)	0.0381 (10.2)	0.0514 (10.7)	-0.0185 (-6.4)	-0.0025 (-1.2)	0.0218 (4.8)	0.0159 (3.5)	0.0231 (5.9)	0.4812 (2.6)
c) $U_g.U_o.\hat{F}_o.R_o$	0.4529 (162.7)	0.4068 (115.7)	0.3632 (86.2)	0.3939 (105.8)	0.3254 (67.6)	0.4449 (152.8)	0.4955 (235.5)	0.3424 (75.4)	0.3415 (74.9)	0.3828 (98.1)	17.2563 (93.3)
d) $U_t.\hat{F}_o.R_o-U_o.\hat{F}_o.R_o-U_g.U_o.\hat{F}_o.R_o$	-0.1745 (-62.7)	-0.0551 (-15.7)	0.0580 (13.8)	-0.0215 (-5.8)	0.1560 (32.4)	-0.1538 (-52.8)	-0.2851 (-135.5	0.1120 (24.6)	0.1143 (25.1)	0.0073 (1.9)	1.2469 (6.7)
e) $dU.d\hat{F}.R_o$	-0.0376 (-13.5)	0.0112 (3.2)	-0.0268 (-6.4)	-0.0310 (-8.3)	-0.0599 (-12.4)	0.0018 (0.6)	-0.0028 (-1.3)	-0.0187 (-4.1)	-0.0103 (-2.3)	-0.0167 (-4.3)	-1.3022 (7.0)
f) $dU.\hat{F}_o.dR$	-0.0916 (-32.9)	-0.0622 (-17.7)	0.0183 (4.4)	0.0309 (8.3)	0.0323 (6.7)	-0.0148 (-5.1)	-0.0040 (-1.9)	0.0126 (2.8)	0.0031 (0.7)	0.0087 (2.2)	0.0548 (0.3)
g) $U_o.d\hat{F}.dR$	0.0167 (6.0)	0.0048 (1.4)	0.0068 (1.6)	0.0027 (0.7)	0.0052 (1.1)	-0.0001 (-0.02)	0.0005 (0.2)	-0.0004 (-0.1)	0.0017 (0.4)	0.0039 (1.0)	0.1345 (0.7)
h) $dU.d\hat{F}.dR$	0.0090 (3.2)	0.0064 (1.8)	0.0026 (0.6)	-0.0018 (-0.5)	0.0020 (0.4)	0.0007 (0.2)	0.0006 (0.3)	-0.0004 (-0.1)	0.0002 (0.1)	-0.0004 (-0.1)	0.0419 (0.2)
dCS	0.2784 (100)	0.3517 (100)	0.4212 (100)	0.3724 (100)	0.4815 (100)	0.2911 (100)	0.2104 (100)	0.4544 (100)	0.4558 (100)	0.3901 (100)	18.5031 (100)
$U_t.\hat{F}_t.R_t$	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	46.0
$\frac{dCS}{U_o.\hat{F}_o.R_o} \times 100$	38.6%	54.3%	72.8%	59.3%	92.9%	41.1%	26.6%	83.3%	83.8%	64.0%	67.3%

* Figures in brackets show percentages.
** For Sector specifications see Table 3.1, Chapter 3.

Source : Same as Table 8.2.

Transport Service (42) and 236% in Communication (43). Again these are the sectors in which the contribution of structural change in factor price effect on cost share change is significant and negative as can be seen from Table 8.4. That is, in these sectors factor prices increased below the average during 1978-79 to 1983-84.

The effects of changes in primary input coefficients on the cost share changes was significant and positive in sectors like Beverages (14), Tobacco Products (15) and Cotton Textiles (16), while the contribution of the effect of changes in intermediate input coefficients was high and negative again in Tobacco Products (15) and Cotton Textiles (16) over the period 1978-79 to 1983-84 as can be seen from Table 8.4.

Finally, we see that the impact of the four interaction components (e,f,g and h) is small for almost all sectors of the Indian economy during 1978-79 to 1983-84. The effect of interaction of factor price change and primary input coefficient change (component e) is negative in almost all sectors.

Before we conclude this section we will take a look at the trends of cost share changes for the entire period that is, 1968-69 to 1983-84 under study. The results of cost share analysis of the entire period is given in Table 8.5. Over this period of fifteen years, prices in the Indian economy increased by 266.3%. Changes in primary input coefficients contributed 1.7% of the total cost share change of the Indian economy, changes in intermediate input coefficients contributed 2.7%, changes in average factor price 88.1%, while structural changes in factor

Table 8.5 COMPONENTS OF CHANGES IN COST SHARES OF PRIMARY INPUTS BETWEEN 1968-69 AND 1983-84

Components \ Sectors	(1)**	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
$U_o.\hat{F}_o.R_o$	0.3160	0.3661	0.2380	0.2961	0.3195	0.1118	0.1816	0.1672	0.0542	0.3592	0.2914	0.3027
a) $U_o.d\hat{F}.R_o$	-0.0176* (-2.6)	-0.0233 (-3.7)	-0.0232 (-3.0)	-0.0311 (-4.4)	0.0031 (0.4)	-0.0078 (-0.9)	-0.0052 (-0.6)	-0.0252 (-3.0)	-0.0026 (-0.3)	0.0115 (1.8)	0.0091 (1.3)	-0.0405 (-5.8)
b) $U_o.\hat{F}_o.dR$	0.0186 (2.7)	0.0197 (3.1)	0.0316 (4.1)	0.0344 (4.9)	0.0006 (0.1)	0.0217 (2.4)	0.0075 (0.9)	0.0546 (6.6)	0.0190 (2.0)	-0.0061 (-1.0)	-0.0028 (-0.4)	0.0508 (7.3)
c) $U_g.U_o.\hat{F}_o.R_o$	0.7414 (108.4)	0.8591 (135.5)	0.5584 (73.3)	0.6949 (98.7)	0.7497 (110.2)	0.2623 (29.5)	0.4261 (52.1)	0.3922 (47.1)	0.1271 (13.4)	0.8428 (131.5)	0.6838 (96.5)	0.7103 (101.9)
d) $U_t.\hat{F}_o.R_o - U_o.\hat{F}_o.R_o - U_g.U_o.\hat{F}_o.R_o$	-0.0574 (-8.4)	-0.2252 (-35.5)	0.2036 (26.7)	0.0090 (1.3)	-0.0693 (-10.2)	0.6258 (70.5)	0.3923 (47.9)	0.4406 (52.9)	0.8187 (86.6)	-0.2024 (-31.6)	0.0243 (3.4)	-0.0131 (-1.9)
e) $dU.d\hat{F}.R_o$	-0.0484 (-7.1)	-0.0458 (-7.2)	-0.0858 (-11.3)	-0.0809 (-11.5)	-0.0103 (-1.5)	-0.0651 (-7.3)	-0.0270 (-3.3)	-0.1464 (-17.6)	-0.0700 (-7.4)	-0.0024 (-0.4)	0.00004 (0.01)	-0.1300 (-18.6)
f) $dU.\hat{F}_o.dR$	0.0505 (7.4)	0.0485 (7.7)	0.0815 (10.7)	0.0837 (11.9)	0.0082 (1.2)	0.0536 (6.0)	0.0240 (2.9)	0.1245 (15.0)	0.0581 (6.1)	-0.0049 (-0.8)	-0.0116 (-1.6)	0.1290 (18.5)
g) $U_o.d\hat{F}.dR$	0.0034 (0.5)	0.0068 (1.1)	0.0009 (0.1)	0.0015 (0.2)	0.0010 (0.2)	0.0010 (0.1)	0.0015 (0.2)	0.0068 (0.8)	-0.0005 (-0.1)	0.0009 (0.1)	0.0027 (0.4)	0.0027 (0.4)
h) $dU.d\hat{F}.dR$	-0.0064 (-0.9)	-0.0059 (-0.9)	-0.0050 (-0.7)	-0.0075 (-1.1)	-0.0025 (-0.4)	-0.0034 (-0.4)	-0.0008 (-0.1)	-0.0143 (-1.7)	-0.0041 (-0.4)	0.0013 (0.2)	0.0031 (0.4)	-0.0119 (-1.7)
dCS	0.6840 (100)	0.6339 (100)	0.7620 (100)	0.7039 (100)	0.6805 (100)	0.8882 (100)	0.8184 (100)	0.8328 (100)	0.9458 (100)	0.6408 (100)	0.7086 (100)	0.6973 (100)
$U_t.\hat{F}_t.R_t$	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$\frac{dCS}{U_o.\hat{F}_o.R_o} \times 100$	216.1%	173.0%	320.1%	237.5%	212.8%	794.1%	450.3%	497.9%	1742.9%	177.4%	241.0%	230.0%

Table 8.3 COMPONENTS OF CHANGES IN COST SHARES OF PRIMARY INPUTS BETWEEN 1968-69 AND 1983-84

Components \ Sectors	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
$U_o.\hat{F}_o.R_o$	0.2858	0.2757	0.3192	0.3723	0.3581	0.3510	0.2638	0.2938	0.2546	0.2861	0.0677	0.1825
a) $U_o.d\hat{F}.R_o$	-0.0302 (-4.2)	-0.0025 (-0.3)	0.0001 (0.02)	0.0545 (8.7)	0.1125 (17.5)	0.0422 (6.5)	-0.0417 (-5.7)	-0.0020 (-0.3)	-0.0154 (-2.1)	0.0356 (5.0)	-0.0073 (-0.8)	-0.0385 (-4.7)
b) $U_o.\hat{F}_o.dR$	0.0491 (6.9)	-0.0007 (-0.1)	-0.0116 (-1.7)	-0.0342 (-5.4)	-0.0302 (-4.7)	-0.0297 (-4.6)	0.0260 (3.5)	0.0224 (3.2)	0.0235 (3.2)	-0.0068 (-0.9)	0.0386 (4.1)	0.1083 (13.3)
c) $U_g.U_o.\hat{F}_o.R_o$	0.6705 (93.9)	0.6468 (89.3)	0.7490 (110.0)	0.8735 (139.2)	0.8402 (130.9)	0.8236 (126.9)	0.6191 (84.1)	0.6894 (97.6)	0.5974 (80.2)	0.6712 (94.0)	0.1589 (17.0)	0.4282 (52.4)
d) $U_t.\hat{F}_o.R_o-U_o.\hat{F}_o.R_o-$, $U_g.U_o.\hat{F}_o.R_o$	0.0434 (6.1)	0.0771 (10.6)	-0.0687 (-10.1)	-0.2461 (-39.2)	-0.1990 (-31.0)	-0.1749 (-26.9)	0.1166 (15.8)	0.0163 (2.3)	0.1477 (19.8)	0.0419 (5.9)	0.7733 (82.9)	0.3889 (47.6)
e) $dU.d\hat{F}.R_o$	-0.0979 (-13.7)	-0.0366 (-5.1)	-0.0091 (-1.3)	0.0273 (4.4)	0.0122 (1.9)	0.0357 (5.5)	-0.1006 (-13.7)	-0.0417 (-5.9)	-0.0735 (-9.9)	0.0103 (1.4)	-0.1273 (-13.7)	-0.2724 (-33.3)
f) $dU.\hat{F}_o.dR$	0.0851 (11.9)	-0.0016 (-0.2)	0.0068 (1.0)	-0.0455 (-7.3)	-0.1219 (-19.0)	-0.0596 (-9.2)	0.1252 (17.0)	0.0103 (1.5)	0.0717 (9.6)	-0.0693 (-9.7)	0.1163 (12.5)	0.2438 (29.8)
g) $U_o.d\hat{F}.dR$	0.0035 (0.5)	0.0127 (1.8)	0.0097 (1.4)	0.0035 (0.6)	0.0002 (0.03)	0.0047 (0.7)	-0.0008 (-0.1)	0.0070 (1.0)	0.0036 (0.5)	0.0280 (3.9)	-0.0010 (-0.1)	-0.0044 (-0.5)
h) $dU.d\hat{F}.dR$	-0.0093 (-1.3)	0.0292 (4.0)	0.0046 (0.7)	-0.0053 (-0.8)	0.0280 (4.4)	0.0070 (1.1)	-0.0076 (-1.0)	0.0045 (0.6)	-0.0098 (-1.3)	0.0029 (0.4)	-0.0192 (-2.1)	-0.0365 (-4.5)
dCS	0.7142 (100)	0.7243 (100)	0.6808 (100)	0.6277 (100)	0.6419 (100)	0.6490 (100)	0.7362 (100)	0.7062 (100)	0.7454 (100)	0.7139 (100)	0.9323 (100)	0.8175 (100)
$U_t.\hat{F}_t.R_t$	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$\frac{dCS}{U_o.\hat{F}_o.R_o} \times 100$	249.0%	261.8%	212.8%	167.9%	178.2%	184.2%	277.8%	239.4%	292.0%	248.1%	1373.0%	444.3%

Table 8.5 COMPONENTS OF CHANGES IN COST SHARES OF PRIMARY INPUTS BETWEEN 1968-69 AND 1983-84

Components \ Sectors	(25)	(26)	(27)	(28)	(29)	(30)	(31)	(32)	(33)	(34)	(35)	(36)
$U_o.\hat{F}_o.R_o$	0.2162	0.3495	0.2628	0.3549	0.2118	0.2397	0.2127	0.2215	0.2728	0.2571	0.2276	0.3157
a) $U_o.d\hat{F}.R_o$	-0.0352 (-4.5)	0.0705 (10.8)	0.0003 (0.04)	0.2517 (39.0)	-0.0237 (-3.0)	-0.0091 (-1.2)	-0.0457 (-5.8)	-0.0399 (-5.1)	-0.0071 (-1.0)	-0.0282 (-3.8)	-0.0720 (-9.3)	0.0348 (5.1)
b) $U_o.\hat{F}_o.dR$	0.0528 (6.7)	-0.0298 (-4.6)	0.0242 (3.3)	-0.0421 (-6.5)	0.0562 (7.1)	0.0245 (3.2)	0.0820 (10.4)	0.0708 (9.1)	0.0255 (3.5)	0.0494 (6.6)	0.1136 (14.7)	0.0043 (0.6)
c) $U_g.U_o.\hat{F}_o.R_o$	0.5073 (64.7)	0.8201 (126.1)	0.6167 (83.7)	0.8328 (129.1)	0.4970 (63.0)	0.5626 (74.0)	0.4992 (63.4)	0.5198 (66.8)	0.6401 (88.0)	0.6033 (81.2)	0.5340 (69.1)	0.7407 (108.2)
d) $U_t.\hat{F}_o.R_o-U_o.\hat{F}_o.R_o-U_g.U_o.\hat{F}_o.R_o$	0.2741 (35.0)	-0.1705 (-26.2)	0.1171 (15.9)	-0.1891 (-29.3)	0.2910 (36.9)	0.1974 (26.0)	0.2858 (36.3)	0.2067 (26.6)	0.0794 (10.9)	0.1374 (18.5)	0.2372 (30.7)	-0.0595 (-8.7)
e) $dU.d\hat{F}.R_o$	-0.1926 (-24.6)	-0.0537 (-8.3)	-0.0814 (-11.0)	-0.0731 (-11.3)	-0.1382 (-17.5)	-0.0531 (-7.0)	-0.2098 (-26.7)	-0.1562 (-20.1)	-0.0674 (-9.3)	-0.1255 (-16.9)	-0.2897 (-37.5)	-0.0306 (-4.5)
f) $dU.\hat{F}_o.dR$	0.2147 (27.4)	0.0015 (0.2)	0.0444 (6.0)	-0.1708 (-26.5)	0.1155 (14.7)	0.0428 (5.6)	0.2424 (30.8)	0.1890 (24.3)	0.0620 (8.5)	0.1204 (16.2)	0.3581 (46.4)	-0.0001 (-0.02)
g) $U_o.d\hat{F}.dR$	-0.0040 (-0.5)	0.0101 (1.5)	0.0142 (1.9)	0.0120 (1.9)	-0.0003 (-0.03)	0.0010 (0.1)	-0.0094 (-1.2)	0.0034 (0.4)	0.0025 (0.3)	0.0009 (0.1)	-0.0151 (-1.9)	0.0006 (0.1)
h) $dU.d\hat{F}.dR$	-0.0332 (-4.2)	0.0024 (0.4)	0.0018 (0.2)	0.0237 (3.7)	-0.0092 (-1.2)	-0.0058 (-0.8)	-0.0571 (-7.3)	-0.0152 (-1.9)	-0.0077 (-1.1)	-0.0148 (-2.0)	-0.0938 (-12.1)	-0.0059 (-0.9)
dCS	0.7838 (100)	0.6505 (100)	0.7372 (100)	0.6451 (100)	0.7882 (100)	0.7603 (100)	0.7873 (100)	0.7785 (100)	0.7272 (100)	0.7429 (100)	0.7724 (100)	0.6843 (100)
$U_t.\hat{F}_t.R_t$	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
$\frac{dCS}{U_o.\hat{F}_o.R_o} \times 100$	358.9%	184.3%	277.9%	180.9%	368.3%	315.6%	362.4%	327.4%	262.7%	286.0%	337.1%	214.7%

Table 8.5 COMPONENTS OF CHANGES IN COST SHARES OF PRIMARY INPUTS BETWEEN 1968-69 AND 1983-84

Components / Sectors	(37)	(38)	(39)	(40)	(41)	(42)	(43)	(44)	(45)	(46)	TOTAL
$U_o.\hat{F}_o.R_o$	0.3749	0.3222	0.2557	0.2685	0.3581	0.3376	0.3699	0.2651	0.2504	0.3003	12.5590
a) $U_o.d\hat{F}.R_o$	0.4959 (79.3)	0.0551 (8.1)	0.0004 (0.1)	-0.0465 (-6.4)	0.0005 (0.1)	0.0159 (2.4)	0.0249 (4.0)	-0.0403 (-5.5)	-0.0106 (-1.4)	0.0107 (1.5)	0.5572 (1.7)
b) $U_o.\hat{F}_o.dR$	-0.0723 (-11.6)	-0.0205 (-3.0)	0.0244 (3.3)	0.0641 (8.8)	0.0191 (3.0)	-0.0094 (-1.4)	-0.0119 (-1.9)	0.0508 (6.9)	0.0147 (2.0)	0.0047 (0.7)	0.8994 (2.7)
c) $U_g.U_o.\hat{F}_o.R_o$	0.8797 (140.7)	0.7560 (111.5)	0.5999 (80.6)	0.6300 (86.1)	0.8404 (130.9)	0.7923 (119.6)	0.8680 (137.8)	0.6220 (84.6)	0.5876 (78.4)	0.7047 (100.7)	29.4743 (88.1)
d) $U_t.\hat{F}_o.R_o - U_o.\hat{F}_o.R_o - U_g.U_o.\hat{F}_o.R_o$	-0.2718 (-43.5)	-0.0825 (-12.2)	0.1441 (19.4)	0.1012 (13.8)	-0.1997 (-31.1)	-0.1305 (-19.7)	-0.2385 (-37.9)	0.1129 (15.4)	0.1619 (21.6)	-0.0052 (-0.7)	3.8627 (11.6)
e) $dU.d\hat{F}.R_o$	-0.2318 (-37.1)	0.0200 (3.0)	-0.0265 (-3.6)	-0.1572 (-21.5)	-0.0616 (-9.6)	-0.0108 (-1.6)	0.0047 (0.7)	-0.1239 (-16.9)	-0.0361 (-4.8)	-0.0240 (-3.4)	-3.5040 (-10.5)
f) $dU.\hat{F}_o.dR$	-0.2447 (-39.1)	-0.0619 (-9.1)	0.0057 (0.8)	0.1555 (21.2)	0.0415 (6.5)	0.0175 (2.6)	-0.0175 (-2.8)	0.1244 (16.9)	0.0347 (4.6)	0.0117 (1.7)	2.2932 (6.9)
g) $U_o.d\hat{F}.dR$	0.0265 (4.2)	0.0089 (1.3)	0.0124 (1.7)	0.0049 (0.7)	-0.0050 (-0.8)	-0.0010 (-0.1)	-0.0019 (-0.3)	-0.0005 (-0.1)	0.0006 (0.1)	-0.0025 (-0.4)	0.1533 (0.5)
h) $dU.d\hat{F}.dR$	0.0437 (7.0)	0.0027 (0.4)	-0.0161 (-2.2)	-0.0204 (-2.8)	0.0067 (1.0)	-0.0116 (-1.8)	0.0022 (0.3)	-0.0104 (-1.4)	-0.0032 (-0.4)	-0.0004 (-0.1)	-0.2904 (-0.9)
dCS	0.6251 (100)	0.6778 (100)	0.7443 (100)	0.7315 (100)	0.6419 (100)	0.6624 (100)	0.6301 (100)	0.7349 (100)	0.7496 (100)	0.6997 (100)	33.4408 (100)
$U_t.\hat{F}_t.R_t$	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
$\frac{dCS}{U_o.\hat{F}_o.R_o} \times 100$	163.8%	208.5%	289.9%	270.6%	177.5%	189.6%	169.9%	276.7%	299.1%	232.6%	266.3%

* Figures in brackets show percentages.
** For Sector Specifications see Table 3.1, Chapter 3.
Note : There may be some error in the results presented here on account of the 1968-69 table being in a commodity x industry form.

Source : Same as Table 8.2.

price contributed 11.6% of the total change. The four interaction factors together constituted -4% of the total change of which the share of the interaction of factor price change and primary input coefficient change (effect e) was -10.5% while that of factor price change and intermediate input coefficient change (effect f) was 6.9% in the total cost share change.

The sectoral details of cost share change over the period 1968-69 to 1983-84 reflect the same trends as observed for the three subperiods. From Table 8.5 it can be seen that price rises over the fifteen year period were very high in sectors like Forestry and Logging (6) with an increase of 794%, in Fishing (7) with 450%, Coal and Lignite (8) with 498%, Oil and Gas (9) with 1743%, in Petroleum Products (23) with 1373% and in Coal Tar Products (24) with a price increase of 444% in 1983-84 as compared to 1968-69.

The impact of changes in primary input coefficients is very high and different from the overall trend, in Electric, Electronic Machinery (37) with a share of 79% in its total cost share change. The effect of changes in intermediate input coefficients on cost share changes of most sectors is positive though small indicating the increase in the use of intermediate inputs (quantity) by most sectors. The effects of changes in average factor price of primary inputs (effect c) is high in Cash Crops (2), Iron Ore (10), Cotton Textiles (16), Wool, Silk, Synthetic Textiles (17), Electric, Electronic Machinery (37), Railway Transport Service (41) and in Communication (43). In these sectors the effect of structural change in factor price (effect d) on cost share changes is significantly negative

indicating a below average growth of factor prices of these sectors during 1968-69 to 1983-84. When components (c) and (d) are added together we get the effect of the actual change of factor prices on sectoral cost share changes. These two components together constituted more than 90% of the total cost share changes of all sectors indicating that the major impetus to cost share changes of sectors over the period 1968-69 to 1983-84 came from these components.

The effect of interaction of primary input coefficient change and factor price change is negative in most sectors while that of the interaction of factor price change and intermediate input coefficient change is positive in most sectors during 1968-69 to 1983-84. As already mentioned the contribution of the interaction factors together on cost share changes is small for most sectors. The advantages of studying the effects of interaction factors separately from the effects of the factor price change, primary input coefficient change and intermediate input coefficient change have already been explained.

The above analysis of cost share changes had to be conducted using the relative price concept because I-O tables do not provide a breakup of the value added vector into the quantity component (for example, number of persons employed per unit of output in each sector) and the price component (for example, wage rate and other factor prices). This factor may have caused some errors in the results presented in this chapter.

8.3 SUMMARY

This chapter was devoted to studying changes in the cost

shares of primary inputs per unit of final demand for the Indian economy over the period 1968-69 to 1983-84. This analysis was based on the hypothesis that primary inputs are used in all industries whose output is needed directly and indirectly for production of an element of final demand. The changes in cost shares of primary inputs over the period 1968-69 to 1983-84 were factored out into the effects of changes in the technology of using intermediate and primary inputs, of changes in average and structural prices related to the use of primary inputs and into the effects of four interaction factors. The total period was divided into three subperiods 1968-69 to 1973-74, 1973-74 to 1978-79, 1978-79 to 1983-84 and the cost share analysis was conducted for the three subperiods as well as for the total period 1968-69 to 1983-84.

The results showed that prices in the Indian economy increased by 266% in 1983-84 as compared to 1968-69. Price rises were very high in sectors like forestry and logging, fishing, coal and lignite, oil and gas and in petroleum and coal tar products over the same period.

Changes in average factor price was the most important factor affecting cost shares over the period 1968-69 to 1983-84. This factor constituted approximately 88% of the total cost share increase during the same period. Structural change in factor price constituted approximately 11% of the total change in cost shares. Together these two components made up more than 90% of the total cost share change of most sectors. The effect of changes in average factor price was very high in sectors like

cash crops, iron ore, textiles, electric, electronic machinery, railway transport service and communication. On the other hand, the structural change in factor price effect was significantly negative in these sectors indicating a below average growth of factor price of these sectors during 1968-69 to 1983-84.

The contribution of other components on cost share change over the period under study were much smaller. Changes in primary input coefficients contributed 1.7% of the total cost share change while changes in intermediate input coefficients contributed 2.7% of the total change between 1968-69 and 1983-84. For almost all sectors the same trend for these two effects was observed.

The four interaction factors together constituted -4% of the total cost share change. This impact was small for most sectors over the period 1968-69 to 1983-84. By separating the interaction factors we have the advantage of knowing exactly the effect of the four main components on total cost share changes.

The three subperiods reflected the same trends as witnessed for the total period but with some variations. Of the three subperiods, price rise in the Indian economy was highest during the third subperiod 1978-79 to 1983-84 during which prices rose by 67.3%. Price rises during the first and second subperiods were much smaller, the levels being 47.4% and 59% respectively.

The following chapter concentrates on the second main objective of this study, that of studying the impact of structural change on the economic growth of the Indian economy.

CHAPTER 9

ECONOMIC GROWTH AND STRUCTURAL CHANGE

It was mentioned in chapter 2 that the twin ojectives of the present study are to analyse structural changes in the Indian economy over the period 1968-69 to 1983-84, and to study the relationship of such changes with the economic growth of the country over the same period. Chapters 5 to 8 were devoted to studying structural change in the Indian economy. In this chapter we take up the second objective, that is, we attempt to understand the interaction between change in the structure of the Indian economy and its economic progress. That is, we wish to examine how the structural change, which has been taking place in India over the period 1968-69 to 1983-84 and which was examined in preceding chapters, has affected the economic growth of the country.

The importance of structural change in economic development has been recognised for some time. A number of studies in the development literature have accepted the strong general relationship between structural change and economic growth [Kuznets(1968), Chenery(1979), Yotopoulos and Nugent(1976)]. The shift of employment and production from agriculture to other industries as development proceeds has been found to be a universal phenomenon. Gemmell(1982) has studied the connections between development and the growth of the service sector which is another structural phenomenon of universal occurrence. There has also been a lot of research based on I-O analysis which examines

structural change in the economy but at a less aggregate industrial level. These studies compare structure and development between different countries [e.g. Yotopoulos and Nugent(1973)] or between different years in the same country [e.g. Tilanus (1966)]. Some work on structure - development relationships has been done at the regional level also [e.g. Baum, Munro and Schachter (1990)].

In this chapter we propose to study structure - growth relationships in the Indian economy using data stretching over the period 1968-69 to 1983-84. The process of structural change should be such that it is conducive to rapid economic growth of the country. Since independence rapid economic growth has been a major objective of planning in India. This chapter aims at finding out whether the relationship between structural changes and economic growth of the Indian economy over the period under study has been significant or not. That is, whether the extent and direction of structural change taking place in the Indian economy has been favouring growth of the economy or not.

This chapter has been divided into five sections. The methodology used for the analysis is described in section 9.1. Section 9.2 describes the structural changes in the Indian economy with the help of backward and forward linkages while the details of economic growth in the Indian economy over the period under study are chalked out in section 9.3. Section 9.4 explains the results of the structure - growth relationship analysis conducted while a summary of the chapter is presented in section 9.5.

9.1 METHODOLOGY

The aim is to study the relationship between structural change and economic growth of the Indian economy at the national level using data for the period 1968-69 to 1983-84 in this chapter. The I-O technique has been used alongwith the regression technique for this objective. Our approach is as follows: I-O coefficients, as explained in earlier chapters, identify an economy's industrial structure in detail and also the linkages between different industrial sectors. Changes in coefficients have been taken to represent changes in industrial structure and this provides the basis for the analysis of the relationship between structural change and economic growth. We use linkage measures as measures of structural change[1], while we define economic growth as the real gross national product (GNP) of the country. The growth measures have been regressed on the linkage measures to find the relationship between growth and structural change in the Indian economy at the national level.

9.1.1 Measuring Structural Change

According to Hirschman (1958)[2] an industry has two types of linkages - backward and forward linkage. An industry's backward linkages are determined by its purchases of intermediate inputs from other industries while its forward linkages are determined

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1. Forrsell's methodology as used earlier in chapter 5 focussed mainly on factoring out sources of structural change in output. Here we use linkages to show the total structural change in output that has been taking place in the Indian economy.

2. The term linkage was originated by Hirschman(1958) although the concept dates from Rasmussen (1956).

by sales of it's product to be intermediate inputs for other industries. The propulsive character of a linkage comes into play by changes in the output in an industry creating increased demand for the products of other industries (backward linkages) and/or providing increased supply of product to be used as intermediate inputs in other industries (forward linkages). For example, increased output in the paper industry will have a backward linkage effect to increase output in the forestry and chemical industries while increased output in the electric power industry will have a forward linkage effect to increase output in the machinery industries.

Since the linkage concept is based on industrial interdependence the best way to calculate sectoral linkages is with the help of I-O tables. The measurement of linkages in an I-O framework have been made based on the Leontief technology matrix (the matrix A) or the Leontief inverse [the matrix$(I-A)^{-1}$]. In this context three different approaches can be distinguished - the Chenery-Watanabe(1958) approach, the Yotopoulos-Nugent(1973) approach and Rasmussen's(1956) approach. Of these, Rasmussen's approach is widely used as it has proved to be superior to the other two approaches on several counts[1].

One point to be noted is that Rasmussen's linkage indices are based on the traditional demand driven Leontief model for calculating both backward and forward linkages. Though the Leontief model explains and measures backward linkages to quite a

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1. For a detailed review of the linkage approach refer to chapter 2, section 2.2.3 and section 2.3.

great extent, it is grossly inadequate for measuring forward linkages. That is, Rasmussen's index suffers from a serious qualitative inconsistency in the evaluation of forward linkages (Jones,1976). In view of the drawback of the Leontief model, recent approaches for measuring forward linkages are based on the output approach (or the supply driven I-O model). Originally developed by Augostinovics (1970)[1], as a method of structural analysis symmetrical to the traditional input approach, the supply driven I-O model has been proposed for linkage evaluation by Jones (1976) and more recently by Bulmer-Thomas (1982) to overcome the conceptual drawbacks of the Rasmussen technique. The application of the supply driven model in the field of forward linkages and key sector analysis have been very few [e.g. Augostinovics (1970), Beyers (1976)]. Though there are some theoretical reservations against this model [Giarratani (1980), Oosterhaven (1981)] it is argued that the supply side model can be safely used to indicate the strength of forward linkages (Oosterhaven,1988). In India there are very few studies [e.g. Venkatramaiah et al (1984), Saxena and Rath (1991)] which have used the output approach for calculating forward linkages to date and inspite of its limitations the Leontief input approach (or demand driven model) continues to be used for this purpose[2].

In the following paragraphs we explain the indices that we

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1. The idea of output coefficients appears in a more or less developed form in the works of Ghosh (1958). In Augostinovics' (1970) work a systematic exposition of the output approach is given in parallel to the input approach.

2. For a review of linkage analysis in India refer to chapter 2, section 2.2.3.

have used for measuring backward and forward linkages for the Indian economy both at the sectoral level and the national level.

For the purpose of the present study backward and forward linkages have been estimated for the years 1968-69, 1973-74, 1978-79 and 1983-84 using the I-O tables of these respective years. Backward linkages have been measured using the simple column multiplier (for overall backward linkage of the economy) and Rasmussen's index (for sectoral backward linkages) applied to the traditional Leontief inverse while the forward linkages have been measured using the simple row multiplier (for overall forward linkage of the economy) and Rasmussen's index (for sectoral forward linkages) applied to the output or supply side inverse.

In the Leontief I-O model we know that the balancing equation is given as :

$$X = (I-A)^{-1} F \quad \text{or} \qquad - 9.1$$

$$X = RF \qquad - 9.2$$

where

X is the vector of gross output levels
F is the vector of final demand
A is the technical coefficient matrix and
R is the Leontief inverse.

In equation (9.1) A matrix is calculated as :

$$A = Z(\hat{X})^{-1} \qquad - 9.3$$

where Z refers to the transaction matrix and $\hat{X}$ denotes a diagonal matrix of gross output levels.

The elements of the Leontief inverse matrix R provide vital

information for estimating backward linkages. The backward linkage index U_j (for a certain sector j) formulated by Rasmussen can be defined as :

$$U_j = \frac{1/n \sum_{i=1}^{n} R_{ij}}{1/n^2 \sum_{i=1}^{n} \sum_{j=1}^{n} R_{ij}} \quad , \qquad (j = 1,2,\ldots,n) \qquad - 9.4$$

where R_{ij} refers to the ith row and jth column element of inverse R and n is the number of sectors.

The numerator of index U_j in equation (9.4) denotes the average stimulus imparted to other sectors by a unit's worth of demand for sector j and the denominator denotes the average stimulus for the whole economy when all final demands increase by unity.

If $U_j>1$ it indicates that sector j draws heavily on the rest of the sectors (leading to above average backward linkages) and vice versa if $U_j<1$. The index U_j is however, based on the method of averaging and consequently does not take into account the spread effects. A sector may be having a high value of backward linkage but may be drawing its inputs from one or a few industries. Rasmussen has, therefore supplemented this index with a measure of variation to reflect the degree of skewness of the input pattern. The following measure of variation, corresponding to the index of backward linkage has been put forward by Rasmussen :

$$V_j = \frac{\sqrt{1/n-1 \sum_{i=1}^{n} (R_{ij} - 1/n \sum_{i=1}^{n} R_{ij})^2}}{1/n \sum_{i=1}^{n} R_{ij}} , \quad (j=1,2,\ldots,n) \qquad - 9.5$$

A high value of V_j can be interpreted as showing that a particular sector j draws heavily on one or a few sectors and a low V_j as an indication that the industry draws evenly on other sectors.

High forward linkages occur when a sector's output is or could be used by many other sectors as an input; by expanding capacity in such a sector, inducements are provided to using industries which now have an incentive to expand output to take advantage of the increased availability of inputs.

Next we will explain why the traditional Leontief model should not be used to measure forward linkages and also explain the output approach (or supply side approach) that we have adopted for measuring the same.

If the Leontief inverse is used then the forward linkage measure would be the row sum of this inverse which in terms of Rasmussen's index becomes :

$$F_i \text{ (say)} = \frac{1/n \sum_{j=1}^{n} R_{ij}}{1/n^2 \sum_{i=1}^{n} \sum_{j=1}^{n} R_{ij}} , \quad (i=1,2,\ldots,n) \qquad - 9.6$$

The numerator of the index F_i in equation (9.6) refers to the ith row of the Leontief inverse which measures the total

impact on sector i when final demand for all sectors increases by unity. If this impact is large, it suggests that increased investment in sector i would induce output increases in all using sectors as users take advantage of the increased availability of inputs. Unfortunately F_i is not a good measure of forward linkages. The assumption that final demand for all sectors increases by unity is misleading, since not all sectors are of equal importance in the structure of demand. With a large I-O table, a small sector (say j) which relies heavily on sector i for inputs will lead to a biased index of forward linkage for sector i. Capacity expansion in sector i based on this 'high' forward linkage might, therefore, have a disappointing impact on the overall rate of growth of the economy, because of the small size of (using) sector j.

In view of this problem it is better to approach forward linkages from a different angle. According to Bulmer-Thomas (1982) the basic idea of forward linkage is to trace the output increases which occur or might occur in <u>using</u> industries when there is a change in the sector supplying inputs, just as with backward linkages we trace the output increases which occur in <u>supplying</u> sectors when there is a change in the sector using their outputs as inputs. Indices of backward linkages such as U_j measure the impact to some extent but indices of forward linkages such as F_i do not (Bulmer-Thomas, 1982). Therefore, forward linkages should be based on the supply side model which is discussed below.

Consider an n sector I-O table. We can write the balance equations by summing down the columns as :

$$X' = i'Z + V' \qquad - 9.7$$

where (') denotes a row vector.

In equation 9.7 therefore,

X' is a row vector of gross outputs
Z is the transaction matrix
V' is a row vector whose elements show the value added in each sector and
i' is the identity vector (row vector)

Now when examining forward linkages, the crucial relationship is that between output of sector i and its uses by other sectors. If this relationship is fixed so that each sector distributes a fixed proportion of its output to other sectors, we get the output coefficient matrix, A*, as :

$$A^* = (\hat{X})^{-1}Z \qquad - 9.8$$

That is, A^* is got by dividing the elements of each row of the Z matrix by the total output of that row sector.

Therefore, we get :

$$X' = X'A^* + V' \qquad - 9.9$$

which gives the supply side (or output approach) I-O solution as:

$$X' = V'[I-A^*]^{-1} \qquad - 9.10$$

Let the elements of $(I-A^*)^{-1}$ be denoted by R^*ij. Then equation (9.10) can be written as :

$$X' = V'R^* \qquad - 9.11$$

Suppose now that value added in the ith sector increases by unity. Because of the assumption of fixed output proportions this

will induce forward linkages throughout the economy as using sectors respond to the stimulus; the total increase in output for the whole system is given by $\sum_{j=1}^{n} R^*_{ij}$,that is, the row sum of the $(I-A^*)^{-1}$ matrix.

Rasmussen's forward linkage index is therefore modified as follows :

$$U_i = \frac{1/n \sum_{j=1}^{n} R^*_{ij}}{1/n^2 \sum_{i=1}^{n} \sum_{j=1}^{n} R^*_{ij}} \quad , \quad (i=1,2,\ldots,n) \qquad - 9.12$$

and the coefficient of variation corresponding to the forward linkage index U_i becomes :

$$V_i = \frac{\sqrt{1/n-1 \sum_{j=1}^{n} (R^*_{ij} - 1/n \sum_{j=1}^{n} R^*_{ij})^2}}{1/n \sum_{j=1}^{n} R^*_{ij}} \quad , \quad (i= 1,2,\ldots,n) \qquad - 9.13$$

This new measure of forward linkages (U_i) is quite different from the previous one (F_i), because it measures the forward linkage as the increase in the output of <u>all</u> using industries rather than as the increase in the output of the <u>(one)</u> supplying industry which is actually the essence of forward linkages (Bulmer-Thomas, 1982).

Thus $U_i > 1$ implies a sector with high (above average) forward linkages and vice versa if $U_i < 1$. V_i shows the extent to which all using industries draw evenly on industry i. That is, a high V_i

indicates that one or a few sectors use the output of sector i while a low V_i shows that sector i supplies evenly to the other sectors.

In section 9.2 which follows we describe the results of indices U_j, V_j, U_i and V_i for the 46 sectors of the Indian economy for all the four years under reference. Indices U_j and U_i show the strength of linkages while indices V_j and V_i show the diversity of linkages. The higher the value of U_j and U_i the higher are the linkages for any sector while relatively lower V_j and V_i are better for any sector since they show more evenly spread out linkages.

Since we will be carrying out our analysis of structure - growth relationship at the national level, not the industry level we need to develop linkage measures which are an aggregate of U_j's and U_i's of all 46 sectors in a particular year. In the following section 9.2 we describe linkages at the sectoral level in detail only in order to make a comparative investigation of structural changes across sectors for the four years under study.

The overall linkage measure for the Indian economy for the purpose of this study has been computed by taking the average of linkage measures of all the 46 sectors of the Indian economy in a particular year. However the average of U_js (as computed above) always equals unity. The same is true for the average of U_is (as computed above) also. This is because Rasmussen's indices U_j and U_i do not compute the absolute value of linkages. Instead the linkage value of each sector (whether U_j or U_i) is a proportion of the mean value of the sum of all the elements of the $(I-A)^{-1}$ matrix.

Therefore, in order to compute the overall backward and forward linkages for the Indian economy we took recourse to the following :

(a) The backward linkages for each sector were computed using the simple column multipliers that is, the column sums of the Leontief inverse matrices, R, of 1968-69, 1973-74, 1978-79 and 1983-84.

(b) The forward linkages for each sector were computed using the simple row multipliers that is, the row sums of the supply side inverse matrices, R^*, for each of the four reference years.

(c) The overall backward linkage index (BL_t) of a particular year t for the Indian economy was then computed by taking the average of the backward linkages of all the sectors of that year as computed in (a). This measure has been calculated for all four years under study.

(d) The overall forward linkage index (FL_t) of a particular year t for the Indian economy was similarly computed by taking the average of the forward linkages of all 46 sectors of that year as computed in (b) above. This measure has also been computed for the four years under study - 1968-69, 1973-74, 1978-79 and 1983-84.

9.1.2 Measuring Economic Growth

For the purpose of the present analysis we take real Gross National Product (GNP) as the measure of economic growth. In this case also we computed GNP by sectors as well as the overall GNP of the Indian economy for the four reference years. To compute the same we again took the help of the I-O tables for the years

1968-69, 1973-74, 1978-79 and 1983-84. As in the case of sectoral linkages we have computed GNP (or gross value added, GVA) by sectors in the following section 9.3 in order to see the contribution of each sector in India's economic growth in the four different years as well as the variation in GNP (or GVA) across sectors.

To study the structure - growth relationship at the national level (which is the main objective of this chapter) however, we need to compute the overall real GNP as a measure of economic growth for the four years under study. This has been done by taking the sum of GVA (at constant 1983-84 prices) of all sectors of a particular year. In the next subsection we specify the regression model that has been used to study the relationship between structural change and economic growth.

9.1.3 Linkage Measures And Economic Growth

We are interested in studying whether higher linkages are associated with economic growth over time or not. More concisely, we wish to find out whether the variety of backward and forward linkages are associated with economic growth of the country. That is, the objective of this subsection is to present a model to analyse the effect of structural change in India on the economic growth of the country over time. In order to study this relationship overall real gross national product (GNP) is regressed on overall backward linkage index (BL) and on the overall forward linkage index (FL) separately. To study the structure - growth relationship a linear specification of the regression models is proposed. The models are as follows :

$$GNP_t = a + b\,(BL_t) + u \qquad - 9.14$$

$$GNP_t = c + d\,(FL_t) + v \qquad - 9.15$$

where GNP_t is the overall gross national product of the Indian economy in period t, BL_t is the overall backward linkage of the Indian economy in period t and FL_t is the overall forward linkage measure of the Indian economy also in period t. u and v represent the random disturbance terms.

The estimation of the above regression models [i.e. equations (9.14) and (9.15)] has been done by using the OLS method.

9.2 LINKAGE MEASURES FOR INDIA

We calculated the six linkage measures (i.e., U_j, U_i, V_j, V_i, BL and FL) for India for the four years - 1968-69, 1973-74, 1978-79 and 1983-84, for which the I-O tables exist. Indices U_j, U_i, V_j and V_i have been calculated for each of the 46 sectors in the I-O tables. Indices BL and FL have been calculated as measures of backward linkage and forward linkage for the overall Indian economy for each of the four years under study. Tables 9.1 and 9.2 give the overall and sectoral backward and forward linkages for the four reference years. Table 9.1 gives the backward linkages for 1968-69, 1973-74, 1978-79 and 1983-84 while Table 9.2 gives the supply side forward linkages for these four years.

From Table 9.1 it can be observed that sectors with high values of backward linkage index U_j (top ten) for the year 1968-69 are in order of ranking : Electric, Electronic Machinery

Table 9.1 : DEMAND SIDE MULTIPLIERS FOR 1968-69, 1973-74, 1978-79 AND 1983-84

Sector No.*	Rasmussen's Backward Linkage Index Uj 1968-69	1973-74	1978-79	1983-84	Rasmussen's Backward Linkage Variation Index Vj 1968-69	1973-74	1978-79	1983-84
1.	0.7849(33)**	0.7535(34)	0.8237(32)	0.8106(34)	5.4243(9)	5.4431(8)	4.8594(13)	4.7607(12)
2.	0.7015(39)	0.7268(37)	0.7215(36)	0.7362(36)	5.7120(8)	5.4096(9)	5.1526(9)	4.9911(10)
3.	0.5916(43)	0.6164(43)	0.6350(43)	0.6521(43)	6.3565(4)	6.0549(4)	5.6210(5)	5.3536(5)
4.	0.6358(42)	0.6788(40)	0.6778(40)	0.7009(38)	6.1025(6)	5.7342(6)	5.3612(6)	5.1710(8)
5.	0.9568(30)	1.0464(25)	0.8990(31)	0.9100(32)	4.3011(18)	3.9111(24)	4.2367(18)	4.1479(16)
6.	0.5725(46)	0.5711(46)	0.5762(46)	0.5995(45)	6.5806(1)	6.5452(1)	6.1475(1)	5.8219(2)
7.	0.5871(44)	0.6040(44)	0.5863(45)	0.5856(46)	6.4066(3)	6.1794(3)	6.0364(3)	5.9459(1)
8.	0.6467(41)	0.6671(41)	0.7231(35)	0.8066(35)	5.9719(7)	5.6305(7)	4.9858(12)	4.3967(14)
9.	0.5841(45)	0.5946(45)	0.6002(44)	0.6123(44)	6.4425(2)	6.3165(2)	5.9433(4)	5.7435(3)
10.	0.7389(37)	0.7200(38)	0.7072(37)	0.6707(41)	5.0710(11)	5.1732(11)	4.9997(11)	5.1886(7)
11.	0.7576(35)	0.7448(36)	0.6663(41)	0.6930(39)	4.9516(14)	5.0078(14)	5.3040(7)	5.0199(9)
12.	1.0610(22)	1.2959(3)	1.0473(26)	1.1306(16)	4.1016(22)	3.5000(37)	3.7004(27)	3.5340(32)
13.	1.2597(5)	1.2839(4)	1.2371(7)	1.2705(4)	3.5080(37)	3.3622(40)	3.2606(40)	3.1615(44)
14.	1.2254(9)	1.2036(11)	1.1842(14)	1.1019(19)	3.1197(42)	3.1378(43)	3.0536(44)	3.2140(41)
15.	1.0059(25)	0.9676(30)	1.1111(19)	0.9825(29)	3.9077(27)	4.2716(19)	3.4242(32)	3.9242(21)
16.	1.2327(8)	1.1390(17)	1.3046(3)	1.0948(24)	3.8680(28)	3.7686(28)	3.4959(29)	3.8825(23)
17.	1.4052(3)	1.3612(2)	1.2654(5)	1.1717(10)	2.8286(46)	3.0390(45)	3.0730(43)	3.7255(27)
18.	1.1180(17)	1.1444(16)	1.0557(23)	0.9754(31)	3.8087(30)	3.5313(34)	3.5377(28)	3.9634(20)
19.	0.9593(29)	0.8768(31)	0.9596(30)	0.9786(30)	4.2169(19)	4.6994(15)	4.2406(17)	4.1111(17)
20.	1.1810(12)	1.1065(19)	1.1250(18)	1.1671(13)	4.0837(23)	4.2954(18)	4.0574(20)	4.0996(19)
21.	1.1191(16)	1.2411(8)	1.2249(10)	1.1344(15)	3.9287(25)	3.7946(26)	3.4473(30)	3.8142(25)
22.	1.2429(7)	1.0934(21)	1.1546(16)	1.1030(17)	3.7694(33)	3.9441(22)	3.4338(31)	3.5715(30)
23.	1.0044(26)	1.1047(20)	1.1053(20)	1.0963(23)	4.5335(16)	4.3561(17)	4.1351(19)	4.1058(18)
24.	1.0820(19)	1.0848(23)	1.1359(17)	1.3528(1)	3.8621(29)	3.7315(29)	3.4136(35)	2.9405(46)
25.	1.0385(24)	1.0395(26)	1.0852(21)	1.2050(8)	3.9108(26)	3.9986(21)	3.8594(23)	3.5105(33)
26.	1.3500(4)	1.1875(12)	1.2900(4)	1.2571(5)	3.0639(44)	3.3214(42)	3.0240(45)	3.1413(45)
27.	1.1754(14)	1.1675(15)	1.2036(12)	1.1605(14)	3.5150(36)	3.5535(33)	3.1346(42)	3.2139(42)
28.	1.4479(2)	1.2166(10)	1.2563(6)	1.1733(9)	3.0652(43)	3.5313(35)	3.3288(37)	3.5623(31)
29.	1.0038(27)	1.0040(28)	1.0498(24)	1.1001(21)	3.7959(31)	3.7256(30)	3.4159(34)	3.2040(43)
30.	0.9861(28)	0.8237(32)	0.7965(34)	1.0182(27)	4.0482(24)	0.4665(46)	4.6355(15)	3.6653(28)
31.	1.0633(21)	1.1389(18)	1.1785(15)	1.3048(2)	4.2109(20)	4.0309(20)	3.9992(21)	3.8318(24)
32.	1.1357(15)	1.2631(6)	1.2008(13)	1.2538(6)	4.4700(17)	3.9031(25)	3.7580(25)	3.3225(39)
33.	1.1765(13)	1.1841(14)	1.2172(11)	1.1685(12)	3.4437(39)	3.6920(31)	3.2735(38)	3.3520(38)
34.	1.1971(11)	1.2647(5)	1.4378(1)	1.3026(3)	3.4897(38)	3.5572(32)	3.1390(41)	3.3956(37)
35.	0.8953(32)	1.1844(13)	0.9879(28)	1.2387(7)	4.2036(21)	3.5195(36)	3.8688(22)	3.4039(36)
36.	1.2532(6)	1.2509(7)	1.2368(8)	1.1689(11)	3.4157(40)	3.4332(39)	3.4219(33)	3.4465(35)
37.	1.5262(1)	1.3648(1)	1.3169(2)	1.1003(20)	2.9678(45)	3.1052(44)	3.0105(46)	3.6457(29)
38.	1.2100(10)	1.2388(9)	1.2324(9)	1.0725(25)	3.3957(41)	3.3488(41)	3.2706(39)	3.7269(26)
39.	1.1006(18)	1.0853(22)	1.0711(22)	1.0987(22)	3.5424(35)	3.4871(38)	3.3733(36)	3.2295(40)
40.	0.9504(31)	1.0099(27)	1.0484(25)	1.1029(18)	4.9730(13)	4.6965(16)	4.5463(16)	4.3185(15)
41.	1.0388(23)	0.9952(29)	0.9822(29)	1.0479(26)	3.7810(32)	3.9199(23)	3.7267(26)	3.4523(34)
42.	1.0684(20)	1.0622(24)	1.0353(27)	0.9941(28)	3.6016(34)	3.7881(27)	3.7986(24)	3.8890(22)
43.	0.7469(36)	0.7186(39)	0.6800(39)	0.6633(42)	5.0195(12)	5.1813(10)	5.1955(8)	5.2425(6)
44.	0.7291(38)	0.7679(33)	0.8111(33)	0.8268(33)	5.2449(10)	5.0792(12)	4.6680(14)	4.4549(13)
45.	0.6697(40)	0.6587(42)	0.6508(42)	0.6722(40)	6.1175(5)	5.9673(5)	6.1111(2)	5.6174(4)
46.	0.7832(34)	0.7474(35)	0.7050(38)	0.7331(37)	4.8627(15)	5.0355(13)	5.0583(10)	4.8314(11)
IndexBL	1.801796	1.814429	1.912606	1.943702	Total Indian Economy Backward Linkage Index BL			

* For Sector specifications see Table 3.1, Chapter 3

** Figures in parentheses show ranking. Thus rank (1) indicates the sector with the highest value of Index Uj or Vj

(sector 37), Pesticides, Drugs, Other Chemicals (28), Wool, Silk, Synthetic Textiles (17), Fertilisers (26), Food Products excluding Sugar (13), Other Machinery (36), Rubber and Plastic Products (22), Cotton Textiles (16), Beverages (14) and Transport Equipment and Miscellaneous Manufacturing (38).

For the year 1973-74 the top ten sectors on the basis of ranking of index U_j are : Electric, Electronic Machinery (37), Wool, Silk, Synthetic Fibre Textiles (17), Sugar (12), Food Products excluding Sugar (13), Agricultural Machinery (34), Other Basic Metal Industry (32), Other Machinery (36), Leather and Leather Products (21), Transport Equipment and Miscellaneous Manufacturing (38) and Pesticides, Drugs, Other Chemicals (28). For the year 1978-79 these sectors in order of ranking are : Agricultural Machinery (34), Electric, Electronic Machinery (37), Cotton Textiles (16), Fertilisers (26), Wool, Silk, Synthetic Fibre Textiles (17), Pesticides, Drugs, Other Chemicals (28), Food Products excluding Sugar (13), Other Machinery (36), Transport Equipment and Miscellaneous Manufacturing (38) and Leather and Leather Products (21).

For the year 1983-84 the top ten sectors on the basis of ranking of U_j are : Coal Tar Products (24), Iron and Steel (31), Agricultural Machinery (34), Food Products excluding Sugar (13), Fertilisers (26), Other Basic Metal Industry (32), Machinery for Food and Textile Industry (35), Basic Heavy Chemicals (25), Pesticides, Drugs, Other Chemicals (28) and Wool, Silk, Synthetic Fibre Textiles (17).

Thus, over the period 1968-69 to 1983-84 we see that there

have been some changes in the sectors with high values (top ten) of backward linkage index U_j. Coal Tar Products (24), Iron and Steel (31), Food and Textiles Machinery (35) and Basic Heavy Chemicals (25) have emerged as key sectors (from the point of view of backward linkage only) in 1983-84 as compared to earlier years. On the other hand, sectors like Beverages (14), Rubber and Plastic Products (22) and Sugar (12) do not feature in the top ten sectors in 1983-84 as compared to 1968-69 and 1973-74.

Thus, overall we see that the top ten sectors from the point of view of backward linkage only, over the period 1969-69 to 1983-84, comprise the major groups of chemicals, machinery, metal product industry, textiles and manufactured food products industry.

Similarly from Table 9.2 it can be seen that sectors with high values of forward linkage index U_i (top ten) for the year 1968-69 in order of ranking are : Crude Petroleum, Natural Gas (9), Other Basic Metal Industry (32), Basic Heavy Chemicals (25), Other Minerals (11), Coal and Lignite (8), Fertilisers (26), Coal Tar Products (24), Electricity, Gas, Water Supply (40), Paper and Paper Based Industry (20) and Iron and Steel (31).

Comparing the top ten sectors (from the point of view of forward linkages only) of 1968-69 with those of the succeeding years we find that there is virtually no change in the trend observed in 1968-69. That is, the order of ranking of sectors on the basis of index U_i is almost the same in all the four years under study.

For a better understanding of the sectoral results presented in Tables 9.1 and 9.2 we computed simple rank correlation

Table 9.2 : SUPPLY SIDE MULTIPLIERS FOR 1968-69, 1973-74, 1978-79 AND 1983-84

Sector No.*	Modified Rasmussen's Forward Linkage Index Ui 1968-69	1973-74	1978-79	1983-84	Rasmussen's Forward Linkage Variation Index Vi 1968-69	1973-74	1978-79	1983-84
1.	0.5670(40)**	0.5239(41)	0.5477(41)	0.5743(42)	6.3484(7)	6.2212(3)	6.0928(5)	5.9706(5)
2.	0.8391(22)	0.8656(23)	0.9033(22)	0.9650(20)	4.1593(22)	3.7779(26)	3.6349(24)	3.5983(30)
3.	0.7841(27)	0.6813(30)	0.7681(28)	0.7984(29)	4.2931(21)	4.5051(17)	4.1367(19)	4.1701(20)
4.	0.7435(29)	0.7251(26)	0.7095(30)	0.7884(31)	4.5848(18)	4.3675(19)	4.4049(18)	4.2854(19)
5.	0.6770(34)	0.7133(27)	0.6579(33)	0.6694(36)	4.8348(16)	4.3353(20)	4.6253(15)	4.7766(15)
6.	1.0206(20)	0.9777(14)	0.9153(20)	0.8605(24)	3.5446(32)	3.3977(33)	3.3918(30)	3.7776(27)
7.	0.4981(43)	0.7131(28)	0.5826(39)	0.5597(44)	6.3746(6)	4.3162(21)	5.0950(11)	5.5353(7)
8.	1.5390(5)	1.2693(6)	1.5173(5)	1.6674(5)	2.2160(45)	2.4534(43)	2.1805(45)	2.1491(45)
9.	4.1012(1)	5.9196(1)	5.1597(1)	2.7131(1)	2.6929(41)	2.6505(42)	2.2219(43)	2.4488(42)
10.	1.0874(14)	0.9683(16)	0.8816(24)	0.9136(21)	3.4477(34)	3.3891(34)	3.6175(25)	3.6469(28)
11.	1.6458(4)	2.0312(3)	1.6383(3)	1.7312(4)	2.5369(42)	2.1531(45)	2.2033(44)	2.2674(43)
12.	0.5761(38)	0.5014(43)	0.6033(37)	0.5816(41)	5.6671(9)	5.9772(6)	5.0269(12)	5.4012(10)
13.	0.7031(33)	0.6158(37)	0.5905(38)	0.6154(38)	5.2394(13)	5.3734(10)	5.5890(8)	5.6366(6)
14.	0.4906(44)	0.4918(45)	0.4923(45)	0.4993(46)	6.4909(5)	6.1117(4)	6.1119(3)	6.3270(3)
15.	0.4687(46)	0.4775(46)	0.4483(46)	0.5082(45)	6.7822(1)	6.7795(1)	6.7711(1)	6.6893(1)
16.	0.6757(35)	0.6182(36)	0.6424(34)	0.6873(35)	5.9692(8)	5.2921(11)	5.7758(6)	5.4503(9)
17.	0.6303(36)	0.5763(39)	0.5158(44)	0.6382(37)	5.3992(12)	5.6593(8)	6.1022(4)	6.0783(4)
18.	0.7239(32)	0.6485(35)	0.6257(35)	0.6881(34)	4.9362(15)	4.8875(14)	4.8967(13)	4.9590(12)
19.	1.0836(15)	0.9405(20)	1.0123(17)	1.0664(16)	3.7171(31)	3.5044(31)	3.4553(27)	3.5187(31)
20.	1.2197(9)	1.1096(10)	1.0785(12)	1.1002(11)	3.4771(33)	3.6067(29)	3.5774(26)	3.6451(29)
21.	0.5544(41)	0.5585(40)	0.5237(43)	0.5916(39)	6.6356(3)	6.6205(2)	6.5852(2)	6.4823(2)
22.	1.0635(16)	0.9568(17)	1.0367(14)	0.8599(25)	3.9588(27)	3.7293(27)	3.3073(33)	4.0559(21)
23.	1.1576(12)	1.0514(12)	1.2461(10)	1.2619(10)	2.9927(39)	2.9541(41)	2.6205(41)	2.7880(41)
24.	1.3718(7)	1.2212(8)	1.3570(7)	1.4073(8)	2.3947(43)	2.9819(40)	2.9000(40)	2.8685(40)
25.	1.8842(3)	1.7243(4)	1.7255(2)	1.8954(2)	1.9956(46)	2.1230(46)	2.1493(46)	2.1244(46)
26.	1.3753(6)	1.3259(5)	1.4159(6)	1.4105(7)	3.3660(36)	3.1156(38)	3.1707(36)	3.1210(35)
27.	1.1768(11)	1.0587(11)	1.0705(13)	1.1289(13)	2.9432(40)	3.1598(37)	3.1259(37)	3.1668(34)
28.	1.0900(13)	0.9731(15)	1.0840(11)	1.0004(18)	3.7833(30)	3.6600(28)	3.2865(34)	3.7815(26)
29.	1.0619(17)	0.9379(21)	1.0199(15)	1.0711(15)	4.0512(24)	4.2534(22)	4.0584(20)	3.8988(23)
30.	1.0283(18)	0.9496(18)	0.9053(21)	0.9819(19)	4.1009(23)	4.0353(25)	4.0174(21)	3.8180(24)
31.	1.1819(10)	1.2566(7)	1.2796(8)	1.4645(6)	3.4458(35)	3.1018(39)	3.1957(35)	3.2025(33)
32.	2.1525(2)	2.1623(2)	1.6066(4)	1.8135(3)	2.3691(44)	2.1751(44)	2.5341(42)	2.2474(44)
33.	0.8353(23)	1.0043(13)	1.0133(16)	1.1133(14)	3.8934(28)	3.4651(32)	3.0842(39)	3.0085(38)
34.	0.5169(42)	0.6089(38)	0.6187(36)	0.8353(26)	6.5932(4)	5.6049(9)	5.4911(9)	4.6182(16)
35.	0.4727(45)	0.6738(32)	0.6795(31)	0.7353(33)	6.7257(2)	4.7863(15)	4.6065(17)	4.9404(13)
36.	0.7339(31)	0.7094(29)	0.9638(19)	0.7905(30)	4.9990(14)	4.5747(16)	3.4529(28)	4.3418(17)
37.	0.7542(28)	0.6640(33)	0.6715(32)	0.7416(32)	4.8209(17)	4.9528(12)	4.8174(14)	4.7958(14)
38.	0.8108(24)	0.6603(34)	0.7152(29)	0.8192(28)	4.3959(19)	4.8970(13)	4.6149(16)	4.3155(18)
39.	0.5856(37)	0.5107(42)	0.5298(42)	0.5711(43)	5.4905(11)	5.8314(7)	5.6047(7)	5.4610(8)
40.	1.3020(8)	1.1437(9)	1.2670(9)	1.3728(9)	3.0138(38)	3.2636(36)	3.1207(38)	3.0572(37)
41.	0.8641(21)	0.8688(22)	0.9001(23)	1.0395(17)	3.8053(29)	3.5622(30)	3.3711(31)	3.0734(36)
42.	0.7375(30)	0.7493(24)	0.8737(25)	0.9045(22)	4.3829(20)	4.2525(23)	3.8664(23)	3.8096(25)
43.	0.8100(25)	0.6769(31)	0.8633(26)	0.8974(23)	4.0380(25)	4.3945(18)	3.4274(29)	3.4684(32)
44.	0.8092(26)	0.7450(25)	0.7882(27)	0.8347(27)	3.9947(26)	4.1419(24)	3.9817(22)	3.8997(22)
45.	1.0249(19)	0.9460(19)	1.0040(18)	1.1642(12)	3.3589(37)	3.2866(35)	3.3302(32)	2.8994(39)
46.	0.5705(39)	0.4948(44)	0.5511(40)	0.5883(40)	5.6386(10)	6.0398(5)	5.3859(10)	5.3482(11)
IndexFL	2.134577	2.287034	2.298719	2.191319	Total Indian Economy Forward Linkage Index FL			

* For Sector specifications see Table 3.1, Chapter 3

** Figures in parentheses show ranking. Thus rank (1) indicates the sector with the highest value of Index Ui or Vi

coefficients[1] between U_js and U_is, between U_js and V_js and also between U_is and V_is.

On the whole, the rank correlation coefficient between U_j and U_i of 1968-69 is -0.0945, for 1973-74 it is -0.2582, for 1978-79 it is -0.0797 while for 1983-84 this figure is 0.1438. This implies that sectors with high backward linkages are not the ones with high forward linkages for the Indian economy in all the four years under study. But it can be seen that the rank correlation coefficient between U_j and U_i is showing an increasing trend (though small) from 1973-74 onwards which is a reflection of the development of our country.

Another important trend observed (as can be seen from Tables 9.1 and 9.2) is that sectors with high values of U_j and U_i have relatively low values of V_j and V_i respectively. The rank correlation coefficient between U_j and V_j for 1968-69 is -0.9278 while for 1973-74 it is -0.8506. In 1978-79 it is -0.9149 while in 1983-84 this coefficient is -0.8584. Similarly the rank correlation coefficients between U_i and V_i for 1968-69, 1973-74, 1978-79 and 1983-84 are -0.9692, -0.9756, -0.9599 and -0.9581 respectively.

The negative correlation between U_j and V_j implies that the larger the backward linkage inducement of a particular sector, the smaller is the internal variability of the structure of the inducements over the other sectors. In other words, the high backward linkage effects are well spread out over the rest of the sectors that receive the inducements. On the other hand, sectors

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1. The rank correlation coefficients have been computed from the data presented in Tables 9.1 and 9.2.

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Another important trend observed (as can be seen from Tables 9.1 and 9.2) is that sectors with high values of U_j and U_i have relatively low values of V_j and V_i respectively. The rank correlation coefficient between U_j and V_j for 1968-69 is -0.9278 while for 1973-74 it is -0.8506. In 1978-79 it is -0.9149 while in 1983-84 this coefficient is -0.8584. Similarly the rank correlation coefficients between U_i and V_i for 1968-69, 1973-74, 1978-79 and 1983-84 are -0.9692, -0.9756, -0.9599 and -0.9581 respectively.

The negative correlation between U_j and V_j implies that the larger the backward linkage inducement of a particular sector, the smaller is the internal variability of the structure of the inducements over the other sectors. In other words, the high backward linkage effects are well spread out over the rest of the sectors that receive the inducements. On the other hand, sectors

1. The rank correlation coefficients have been computed from the data presented in Tables 9.1 and 9.2.

with small inducements have their inducements rather concentrated on a few sectors so that the beneficiaries of these effects are few in number. Similarly, sectors with a high value of U_i have a relatively low value of V_i (as is observed from their rank correlation coefficients). In other words, the larger the forward linkage effects of a sector, the more likely it is that the effects are spread out evenly over the rest of the using sectors.

Having analysed the linkages at the sectoral level we wish to see the overall trend of both backward and forward linkages for the entire economy over the period under study.

From Table 9.1 we see that the overall backward linkages (as measured by index BL) for the whole economy are 1.801796, 1.814429, 1.912606 and 1.943702 for 1968-69, 1973-74, 1978-79 and 1983-84 respectively.

Similarly from Table 9.2 it can be seen that the overall forward linkages (as measured by index FL) for the entire Indian economy are 2.134577, 2.287034, 2.298719 and 2.191319 for 1968-69, 1973-74, 1978-79 and 1983-84 respectively.

Thus, a comparison of indices BL and FL over the years under study indicates that while index BL shows a consistent increasing tendency this is not so with index FL. Index FL shows an increasing tendency from 1968-69 to 1978-79 but then declines drastically in 1983-84.

9.3 ECONOMIC GROWTH OF INDIA

In this section we examine the contribution of each of the 46 sectors in the economic growth of the country for the years 1968-69, 1973-74, 1978-79 and 1983-84 and also examine the growth

rate in GNP of each sector and the total economy in the subperiods 1968-69 to 1973-74, 1973-74 to 1978-79, 1978-79 to 1983-84 and also over the total period 1968-69 to 1983-84.

Table 9.3 shows the structure of GNP of India for the four periods under study together with the corresponding overall and sectoral growth rates.

From Table 9.3 it can be seen that over the period 1968-69 to 1983-84 the share of agriculture sectors (i.e. sectors 1, 2, 3, 4) in total GNP fell significantly from 38.9 percent in 1968-69 to 27.9% in 1983-84. Each of the agriculture sectors - that is, Food Crops (1), Cash Crops (2), Plantation Crops (3) and Other Crops (4) shows a declining trend in their GNP shares over the fifteen year period. Of the other primary sectors only Animal Husbandry (5), Crude Petroleum and Natural Gas (9) and Other Minerals (11), show a slight increase in their shares from 1968-69 to 1983-84. On account of the decline in the shares of most sectors comprising the primary sector (sectors 1 to 11), its share in total GNP fell drastically from 50.6% in 1968-69 to 39% in 1983-84.

On the other hand, the service sectors' (sectors 41 to 46) share in total GNP rose from 31.0% to 38% of the total GNP from 1968-69 to 1983-84. Of the service sectors, Other Transport Service, Storage and Warehousing (42), Banking and Insurance (45), and Other Services (46) show a significant increase in their shares over the same period. These changes reflect differences in the growth rates of the primary and service sectors. The average annual growth rate of GNP during 1968-69 to 1983-84 for all the primary sectors except Animal Husbandry (5)

STRUCTURE OF GNP OF INDIA (IN 1983-84 PRICES)

Sector No.*	Contribution in TotalGNP(%)				Average Annual Growth Rate Of Production(%)			
	68-69	73-74	78-79	83-84	68-69to 73-74	73-74to 78-79	78-79to 83-84	68-69 to 83-84
1.	18.8	18.9	14.4	13.4	2.9	-1.4	3.6	1.7
2.	5.4	5.8	4.3	4.0	4.4	-2.1	3.7	2.0
3.	1.6	2.1	1.3	1.0	8.7	-4.9	-0.5	0.9
4.	13.1	11.9	10.4	9.5	0.9	1.4	3.2	1.8
5.	4.9	3.5	5.0	5.3	-3.8	11.8	6.4	4.6
6.	3.5	2.0	1.7	2.2	-8.1	1.0	10.2	0.7
7.	1.1	1.1	1.0	0.8	2.1	2.0	0.4	1.5
8.	1.2	1.0	1.0	0.9	-1.7	5.0	3.4	2.2
9.	0.7	0.4	0.6	1.4	-6.3	10.3	25.6	9.1
10.	0.1	0.1	0.1	0.1	11.1	1.6	6.7	6.4
11.	0.2	0.2	0.3	0.4	0.9	12.2	10.2	7.6
12.	0.5	0.002	0.7	0.4	-65.3	225.6	-8.5	1.1
13.	0.8	0.5	1.2	0.8	-5.8	23.4	-2.3	4.3
14.	0.4	0.04	0.04	0.1	-33.4	3.6	29.2	-3.8
15.	0.4	0.3	0.1	0.4	-3.2	-10.7	29.9	4.0
16.	1.3	1.3	0.9	1.9	3.8	-4.4	22.4	6.7
17.	0.1	0.2	0.4	0.7	11.4	17.0	18.9	15.7
18.	0.7	0.6	1.2	1.3	0.9	17.2	7.5	8.3
19.	0.5	0.7	0.6	0.4	8.9	0.02	-3.7	1.6
20.	0.4	0.6	0.5	0.6	13.2	2.6	5.6	7.0
21.	0.4	0.3	0.2	0.2	-3.1	-6.8	13.1	0.7
22.	0.4	0.4	0.3	0.4	3.8	-2.3	10.4	3.9
23.	0.7	0.3	0.1	0.2	-16.8	-8.9	17.5	-3.8
24.	0.1	0.1	0.1	0.02	17.0	-5.1	-20.6	-4.1
25.	0.2	0.3	0.4	0.3	12.2	8.0	-4.3	5.1
26.	0.1	0.1	0.1	0.3	17.9	5.6	23.0	15.2
27.	0.1	0.1	0.1	0.1	3.9	5.2	5.6	4.9
28.	0.1	0.7	0.6	1.1	46.1	0.6	18.4	20.3
29.	0.3	0.3	0.2	0.3	4.3	-0.9	10.4	4.5
30.	0.6	1.4	1.9	0.7	21.9	10.9	-13.5	5.4
31.	1.4	1.4	1.6	1.1	2.4	7.0	-2.0	2.4
32.	0.2	0.1	0.2	0.1	-14.6	17.1	-1.7	-0.6
33.	0.6	0.8	0.4	0.7	8.0	-7.0	15.5	5.1
34.	0.2	0.1	0.1	0.1	-0.9	-13.2	20.3	1.2
35.	0.2	0.2	0.2	0.1	4.2	7.3	-4.7	2.1
36.	0.2	0.5	0.6	0.7	19.1	6.0	11.2	12.0
37.	0.03	0.4	0.4	0.9	72.3	3.7	25.0	30.7
38.	1.1	1.4	1.3	2.2	9.1	1.8	17.1	9.1
39.	5.2	4.4	5.2	5.0	-0.6	7.9	4.3	3.8
40.	1.0	1.4	1.5	1.8	8.6	5.5	9.6	7.9
41.	1.2	1.4	1.5	1.2	5.9	6.5	0.3	4.2
42.	1.8	2.3	2.8	3.5	7.6	9.1	9.3	8.7
43.	0.5	0.5	0.6	0.7	5.4	6.8	8.9	7.0
44.	12.1	13.0	15.9	12.1	4.3	8.4	-0.3	4.1
45.	1.9	2.4	3.2	3.1	7.3	10.7	4.4	7.5
46.	13.5	14.4	14.8	17.4	4.1	4.7	8.6	5.8
Total	100.0	100.0	100.0	100.0	2.85	4.14	5.13	4.04

* For Sector Specifications see Table 3.1, Chapter 3

and Minerals (9,10,11) is less than 3% while for most of the service sectors this growth rate is much higher around 6-8%. The most important exception in the primary sector category is Crude Petroleum and Natural Gas (9) which showed an average annual growth rate of 9.1% during the fifteen year period under study. This might be due to the substitution of oil and gas for other energy sources in various production processes. For example, Coal and Lignite (8) shows a much lower growth rate of only 2.2% during the period 1968-69 to 1983-84.

The secondary sector (sectors 12 to 40) also shows an increase in its share in total GNP from 18.4% in 1968-69 to 23% in 1983-84. Of all the secondary sectors, those which show a very high annual average growth rate over the period under study are Electric, Electronic Machinery (37) with a growth rate of 30.7% annually, Pesticides, Drugs and Other Chemicals (28) with 20.3%, Wool, Silk, Synthetic Textiles (17) with 15.7%, Fertilisers (26) with 15.2%, Other Machinery (36) with 12.0%, Transport Equipment and Miscellaneous Manufacturing (38) with 9.1% and Cotton Textiles (16), Jute, Hemp, Mesta, Other Textiles (18), Paper (20), Electricity, Gas and Water Supply (40) with annual average growth rates ranging from 6 to 8% over the period 1968-69 to 1983-84. These are also the sectors which show a relatively high increase in their GNP shares in 1983-84 as compared to 1968-69. The other secondary sectors show an average annual growth rate of less than 5% and also show either some decline or a constant share in GNP over the period 1968-69 to 1983-84.

Thus, among the secondary sectors there is a shift in favour

of chemicals, machinery, transport equipment, manufacturing, textiles and electricity, gas & water supply sectors as can be seen from their GNP growth rates and increasing GNP shares over the period 1968-69 to 1983-84.

Overall we see that total GNP grew at an average annual growth rate of 2.9% between 1968-69 and 1973-74. Over 1973-74 to 1978-79 the growth rate of total GNP was 4.1%, it was 5.1% per annum over the subperiod 1978-79 to 1983-84 while over the total period 1968-69 to 1983-84 the average annual growth rate of total GNP was 4.04%.

9.4 ECONOMIC GROWTH AND STRUCTURAL CHANGE : REGRESSION RESULTS

The objective of this section is to assess the importance of structural characteristics of the Indian economy in determining the economic growth of the country. That is, we wish to study whether Indian economic growth will be encouraged by the extent to which Indian industries buy inputs from (i.e. backward linkages) and sell output to (i.e. forward linkages) a large number of other industries.

The regression results describing the relationship between overall GNP and overall backward linkages and between overall GNP and overall forward linkages are reported in Table 9.4. The results indicate that the backward linkage index BL is significantly related, with the expected positive sign, to GNP of the country. The regression results performed very well in this case. The coefficient of backward linkage (BL) is highly significant both according to t value and according to the coefficient of determination (i.e. R^2). 90 percent of the

variation in GNP is explained by the regression model (i.e. GNP on BL).

On the other hand, we see that the overall forward linkage index FL has a weak positive effect on overall GNP. The coefficient of determination (R^2) and t value show that the coefficient of forward linkage (FL) is not significant. That is, the regression results did not perform well in the case of forward linkages. This result is surprising. It implies that industrial development in India greatly increased the output of steel, crude petroleum, natural gas and chemicals but expanded supply of these products did not stimulate expansion in the wide range of industries which use them as inputs.

Baum, Munro and Schachter (1990) have found similar relationships both in the case of backward linkages (i.e. a strong positive relationship with GNP) and forward linkages (i.e. an insignificant positive relationship with GNP) for Southern Italy. One reason which they give for the poor performance of the forward linkage index is that forward linkages have measurement problems and the nature of their general development stimulus is less clear than for backward linkages. This might be an explanation of the poor performance of forward linkage index FL in the case of India also, as shown in Table 9.4.

The limitation of the above regression analysis is that measuring structural change by I-O measures precluded the inclusion of other structural change variables (for example, level of urbanisation, employment by industrial sectors etc.) in the equations. Another limitation is the small size of the sample considered for the above time series analysis.

Table 9.4

Linkage Regression Results

I. Regression of GNP on Backward Linkage (BL)

$$GNP_t = -77616475.9 + \underset{(11472897.1)^*}{48924353.3}\ BL_t, \quad R^2 = 0.90$$

II. Regression of GNP on Forward Linkage (FL)

$$GNP_t = 3570256.3 + \underset{(32576510.8)}{4582980.8}\ FL_t, \quad R^2 = 0.01$$

* The figures in parentheses show standard error of coefficients.

9.5 SUMMARY

In this chapter the structure - growth relationship in the Indian economy at the national level was examined using data stretching over the period 1968-69 to 1983-84. Structural change was measured using linkage measures while economic growth was measured as the real GNP of the country. The basic hypothesis was that economic growth of the country would be associated with the backward and forward linkages existing in the economy. The growth measures were regressed on the linkage measures to find the relationship between growth and structural change in the Indian economy. The linkage measures and the growth measures were also analysed at the sectoral level over the period 1968-69 to 1983-84 to study the variations across sectors.

The results showed that the most important sectors from the point of view of backward linkages over the period under study

comprised the major groups of chemicals, machinery, metal product industry, textiles and manufactured food product industry. On the other hand, the most important sectors from the point of view of forward linkages over the same period consisted of the major groups of oil and gas, minerals, chemicals, electricity, gas, water supply, iron and steel, paper, coal tar products and basic metal industry.

Some other trends observed showed that sectors with high backward linkages were not the ones with high forward linkages also, for the Indian economy over the period under study, and sectors with high linkages (whether backward or forward) had their linkage effects well spread out over the rest of the sectors.

The overall backward linkage measure for the Indian economy showed a consistent increasing tendency over the period 1968-69 to 1983-84 but the overall forward linkage measure increased only from 1968-69 to 1978-79, then declined drastically in 1983-84.

The analysis of sectoral GNPs over the period 1968-69 to 1983-84 showed that the share of the primary sector in total GNP fell significantly while those of the secondary and tertiary sectors increased. The average annual growth rate of GNP for the Indian economy was approximately 4% over this period.

The regression results describing the relationship between overall GNP and overall backward and forward linkages showed that GNP was significantly related to measures of backward linkage but not to measures of forward linkage indicating that economic growth in India is encouraged by the extent and pattern in which

Indian industries buy inputs from other industries (i.e. backward linkages) but not by the extent and pattern in which they sell outputs to other industries (i.e. forward linkages). The poor performance of the forward linkage index may be due to measurement problems associated with forward linkages and due to less clarity about the nature of their general development stimulus as compared to backward linkages.

CHAPTER 10

SUMMARY AND CONCLUSIONS

10.1 THE PERSPECTIVE OF THE STUDY AND MAJOR FINDINGS

The primary focus of this study has been an analysis of (i) structural change in the Indian economy over the period 1968-69 to 1983-84 and (ii) the relationship between structural change and growth in the Indian economy. The term structural change has been used to refer to changes in the production structure, changes in the employment structure, changes in costs (or prices) and changes in the technology used in production processes. Most of the analyses presented in this study have been carried out within the context of the static, open, Input-Output model. The Input-Output (I-O) model is essentially a simplified model of production which takes into account the interdependencies among producing sectors in the economy. I-O tables provide the most comprehensive measurement of economic structure. Hence the I-O model is ideally suited for such studies.

For rapid economic development of India a comprehensive strategy has to be evolved which needs efficient planning. The first requirement of such planning is to understand the structure of the economy. The present study is an effort in this direction.

This study has used the Indian I-O tables of 1968-69, 1973-74, 1978-79 and 1983-84 in an attempt to provide a comprehensive analysis of structural change and growth in the Indian economy. The analysis has been conducted for three subperiods viz. 1968-69 to 1973-74, 1973-74 to 1978-79, 1978-79 to 1983-84 as well as for

the total period 1968-69 to 1983-84. Before these analyses were made, however, a number of adjustments were required to improve the comparability of the data. First, the 1968-69, 1973-74 and 1978-79 I-O tables were rebased from current factor prices to 1983-84 factor prices. 1983-84 was chosen as the base year for prices in these exercises as it was the most recent year analysed for the purpose of this study and required no adjustments to be made to the 1983-84 table. Next, certain sectors were aggregated to reduce these tables to a standardised 46 sector classification. Inspite of these adjustments, a certain degree of incomparability remains and the results of this study must be interpreted with appropriate caution.

The study analysing the interindustry data of the period 1968-69 to 1983-84 apparently gives the look of an exercise in economic history of the recent past. But it should be remembered that the latest I-O data available for the Indian economy is for the year 1983-84 which was published only in late 1990. However, the orientation of the present study is to bring together and empirically test the methodology of analysis of structural change in the I-O framework by using the available Indian I-O tables. That is, the two strands viz. methodology and empirics run side by side throughout the study equally importantly. Though of the recent past, the results of the study are important in itself and also because of the importance of the said time vintage (i.e. 1968-69 to 1983-84) when the economy witnessed quick changes in government, two oil price shocks and the advent of liberalisation. Besides this, the importance of the said time

period also emanates from the fact that it covers the Fourth, Fifth and most of the Sixth Plan periods of the Indian economy.

Structural change has been studied by an analysis of changes in output, technology, employment and prices. Before each of these aspects were taken up, an overall comparison of the four constant price I-O tables was presented in Chapter 4 which showed that the database in the I-O tables is consistent with that of National Accounts Statistics. This overall comparison was based on highly summarised I-O tables of the four reference years and involved an analysis of overall changes in final demand and intermediate demand and overall changes in the distribution of outputs and inputs.

The results showed that government consumption (GFCE), gross investment (GI), export (EXP) and import (IMP) categories of final demand increased gradually while private consumption (PFCE) declined sharply as a percent of total final demand over the period 1968-69 to 1983-84. Intermediate demand increased as a proportion of total domestic output signifying the technological development of the Indian economy over the period under study. There are two ways to anticipate the effect of technological change on the requirements of intermediate outputs. On the one hand, if technological change is to be considered technological progress, it should result in a reduction in inputs required to produce a given output. On the other hand, the implemention of new technologies may enhance industrial specialization and actually result in an increase in intermediate deliveries required to produce a given output. An increase in intermediate deliveries resulting from increased specialization does not in

itself imply an increase in the level of inputs employed by an industry. In fact, in terms of costs, increased specialisation is generally associated with a reduction in costs through increased efficiency and economies of scale in production. I-O conventions, however, generally exclude transactions involving commodities produced and consumed in the same enterprise from the I-O accounts. For this reason, an increase in specialization will actually appear in these data as an increase in the deliveries of inputs to a given industry. Following this explanation it can be thus interpreted that due to technological advancement, the proportion of intermediate demand in the total output increased for the Indian economy. On the other hand, the GVA to output ratios declined over the same period. An analysis of interindustry output supply, besides other things, showed a significant decrease in the intermediate use of services in the secondary sector as against an increase in the use of services by the tertiary sector itself. The GVA as a percent of total GVA showed a decline in the primary sector and an increase in the secondary and tertiary sectors reflecting the changing structure of the Indian economy in favour of the latter two sectors. An analysis of the distribution of final demand among its components showed that PFCE accounted for almost the entire final use of the primary sector, PFCE and GI almost equally constituted most of the final use of the secondary sector while 90% of the total final use of the tertiary sector was accounted by PFCE and GFCE together over the period under study. These findings are in accordance with the characteristics of the three sectors.

The first issue to be investigated in detail in this study was the issue of the changing structure of output in the Indian economy and the components of such change. Three exercises were performed in investigating this issue. In the first exercise, the changing structure of producing sectors was analysed in terms of changing shares of each of the 46 sectors in the total output of the economy. In the second exercise, the sources of growth of output were identified and measured. The sources of output growth measured the contribution of factors like changes in I-O relations, average growth of final demand (or changes in the level of final demand), changes in the composition of final demand and changes in the interaction (of final demand change and I-O coefficient change) factor to output growth. Guill (1979) mentions that changes in I-O relations and changes in final demand are interrelated. In his words - `although these elements of change are, in fact, interrelated, these interrelationships could not be identified within the context of the I-O model' (Guill, 1979, pp 284). However in our study we make it possible to measure this interrelationship between final demand change and I-O coefficient change. This component of output growth has been called the interaction factor. The final exercise analysed the contribution of separate demand factors like private consumption, government consumption, gross investment, exports and imports to output growth over the period under study.

The results showed that the structure of Indian production diverted from agriculture to industry, especially to heavy industry and to services over the period 1968-69 to 1983-84 and of all the components, average growth of final demand effect was

the most significant factor affecting the increase in output. The average growth of final demand component was analysed to show the effect on output assuming that the final demand of all sectors had been growing at an average growth rate and technology had remained unchanged. But in actuality final demand of all sectors does not grow at the average rate. That is, the final demand of some sectors increases above the average growth rate while that of some sectors grows below the average growth rate. The impact of deviations of final demand of sectors from the average growth rate, on output increase over the period 1968-69 to 1983-84 was shown by the effect of change in the composition of final demand component of output growth. The effects of changes in the composition of final demand showed a decline in the demand of the output of traditional industries like agriculture, fishing, beverages, tobacco, leather, non metallic minerals, agricultural machinery and construction and an increase in the demand of the output of industries like textiles, paper, chemicals, machinery and electric power over the period 1968-69 to 1983-84. The contribution of this component for the total economy over the period 1968-69 to 1983-84 was positive but small indicating a shift in final expenditures in favour of more interdependent industries and away from the more independent industries like agriculture. This shows that structural change initiated by the government in the area of production has been in the right direction though its degree has been small. The average growth of final demand and change in the composition of final demand components together showed the total impact of a change in final

demand on output assuming that technology had remained constant. These two components contributed approximately 90% of the total increase in output during the period 1968-69 to 1983-84. Most of the remainder of total output increase was contributed by the effect of changes in I-O relations.

While changes in the composition of final demand reflect changes in the priorities of planners and, to a limited extent, shifts in consumer preferences, changes in I-O relations reflect changes in the interdependencies among producing sectors. The impact of changing I-O relations on outputs of industries in India has been small. This small impact of changing I-O relations has been noted in studies of other economies also, and is usually explained as reflecting the offsetting effects of such factors as increasing specialisation, technological change and increased efficiency in the use of intermediate inputs. This finding is also evidence of the general stability of I-O coefficients of an economy. This stability is derived from the stability of the underlying technological relationships as well as the interdependencies among industries.

Although the total requirements of output associated with changes in I-O relations (assuming that final demand had remained constant) appeared to change very little over the period 1968-69 to 1983-84, there were marked shifts in the relative importance of different industries. Due to this effect there was a decline in the demand of the outputs of sectors like agriculture, food products, wood, paper, rubber and plastic products, coal and lignite, non metallic minerals and construction. On the other hand, due to changes in I-O relations there was an increase in

the demand of outputs of sectors like oil and gas, textiles, leather, petroleum and coal tar products, chemicals, cement, iron and steel, machinery, transport equipment, electric power and services over the period 1968-69 to 1983-84. Some of these changes can be associated with specific policy initiatives by the Indian government. For example, the overall strategy of economic growth in India has emphasized the development of heavy industries like iron and steel and machine building industries. These industries produce capital equipment and in this capacity play a major role in building the infrastructure of the Indian economy. Over the period 1968-69 to 1983-84 under consideration, the production of most goods required increased deliveries from heavy industries like iron and steel etc. as a result of which the heavy industry group recorded increases in their outputs over the same period.

Although policy initiatives may explain some of the changes in I-O relations over the period under study, other changes reflect more general patterns which were based on technological trends. For example, in the energy sector there is a shift away from coal in favour of alternative energy sources like petroleum products and electric power. These trends are consistent with increased efficiency in energy use and the transmission of energy over longer distances.

The contribution of the interaction factor in the total change in output during 1968-69 to 1983-84 was small. The importance of this component is due to the fact that by separating this component we get the actual effect of the three

main components instead of getting either overstated or understated effects of these components.

The analysis of different final demand categories showed that over the period 1968-69 to 1983-84, output growth in the Indian economy was largely due to the growth in consumption demand and investment demand. The importance of consumption increased in relation to that of investment over the period under study implying that the Indian economy is moving from an investment - oriented economy to a more consumption - oriented one. The role of foreign trade also increased over the period 1968-69 to 1983-84 showing the opening up of the Indian economy.

The three subperiods reflected the same trends as witnessed for the total period 1968-69 to 1983-84 but with some fluctuations. Structural change in output was fastest during the second subperiod 1973-74 to 1978-79.

The next issue investigated in detail in this study was the issue of structural change in technology. This was studied by examining the change in the most important I-O coefficients. Four exercises were performed to investigate this issue. In the first exercise, the importance of each coefficient was determined by measuring the effects of changes in each coefficient on the output of industries. Over the period 1968-69 to 1983-84 the number of most important coefficients increased while the number of zero coefficients decreased reflecting the technological advancement of the Indian economy. It was observed that a very small group of I-O coefficients was important when the significance of their changes on development of the output of industries was considered. In the second exercise, therefore, 100

most important coefficients were selected and the degree of changes in them investigated for the period 1968-69 to 1983-84. The changes in most of these coefficients was observed to be in the range 0-40%.

In the next exercise, the 100 most important coefficients were used to find out the industries having the most significant impacts on the output development of other industries. The rows and columns of industries were considered separately. The important row industries consisted of agriculture, services, energy, iron and steel, non metallic minerals and chemicals. These are the industries which supply their products to other industries which use them as inputs for producing their outputs. Any change in the coefficients of these supplying industries affects the output of the using industries significantly. The important column industries over the period 1968-69 to 1983-84 consisted of machinery, chemicals, minerals, metals, beverages, tobacco products, sugar, leather, wood, coal tar products and cement. These are the industries whose production methods demand outputs of other industries in such a way that any change in the coefficients of these industries significantly affects the output of other industries from which they draw their inputs.

In the final exercise, the 100 most important coefficients were divided into two groups - one consisting of small coefficients and one consisting of large coefficients and the degree of changes in them investigated through simple graphs. Analysis showed that smaller coefficients changed more than the larger coefficients during 1968-69 to 1983-84 indicating the

importance of small coefficients also in the technological development of the country.

The next aspect of structural change examined in the study was that of employment. This issue was studied like that of output, by examining the change in the contribution of individual sectors to total employment, by examining the sources of any change in employment, and by examining the changes in the direct labour input coefficients of the different sectors in detail.

It was observed that the share of agriculture in total employment declined marginally while those of the secondary and tertiary sectors rose marginally over the period 1973-74 to 1983-84. The share of agriculture in employment was observed to be significantly larger than its share in output indicating the prevalence of large scale disguised unemployment in agriculture and the failure of government policies relating to employment.

The analysis of the sources of employment growth showed that changes in the distribution of final demand and changes in coefficients (both I-O and labour input coefficients) resulted in a significant reduction of labour requirements. These results when compared with the corresponding results related to output shows the conflict between output and employment generation objectives of our Five Year plans. These results also indicate the trend of mechanisation of most production processes in India and the consequent increase in labour productivity over the period under study. The average growth of final demand component resulted in an increase in labour requirements. The positive effect on employment of this component was sufficient to offset the negative effect on employment of the other components and

resulted in a net positive growth (although small) in total labour requirements over the period under consideration.

The analysis of different final demand categories showed results similar to that of output, that is, changes in consumption demand and investment demand were mainly responsible for the employment growth over the period 1973-74 to 1983-84.

The last aspect of structural change investigated in this study was that of changing costs (or prices). There are very few studies so far which have concentrated on the empirical investigation of this aspect of structural change. The main reason for the lack of such study has been the nonavailability of I-O tables both in current and constant prices. This study has investigated the changing cost shares of primary inputs using the relative price concept. This issue was investigated by factoring out the change in cost shares of primary inputs over the period 1968-69 to 1983-84 into the effects of changes in the technology of using intermediate and primary inputs, of changes in average and structural prices related to the use of primary inputs and into the effects of four interaction factors.

Analysis showed that over the period under study, prices rose significantly in sectors like forestry and logging, fishing, coal and lignite, oil and gas, petroleum products and coal tar products. Changes in average factor price was the most important factor affecting cost shares. This factor showed the effect on per unit costs of different industries assuming that the price of primary inputs of all industries had been increasing at an average rate. Structural change in factor price component showed

in which sectors factor prices grew above average or below average and the impact of this on costs (or prices) of different sectors. Factor prices grew much below average in sectors like cash crops, iron ore, textiles, electric, electronic machinery, railway transport service and communication as a result of which this component contributed negatively to the total cost share change of these sectors. The average factor price and the structural change in factor price components together contributed approximately 90% of the cost share change of most sectors, the remainder being contributed by changes in primary input coefficients, changes in intermediate input coefficients and the four interaction components.

The three subperiods showed similar trends in costs. Price rise was highest in the third subperiod 1978-79 to 1983-84.

This study was concluded with an analysis of the structure - growth relationship in the Indian economy. Structural change was measured using simple backward and forward linkage measures while economic growth was measured as real GNP of the country. The growth measures were regressed on the linkage measures to find the relationship between growth and structural change at the national level. This was done using data stretching over the period 1968-69 to 1983-84.

The analysis of linkage measures showed that the most important sectors from the point of view of backward linkages comprised the major groups of chemicals, machinery, metal product industry, textiles and manufactured food product industry while the most important sectors from the point of view of forward linkages over the period under study were oil and gas, minerals,

chemicals, electricity, gas, water supply, iron and steel, paper, coal tar products and basic metal industry.

The analysis of GNP showed that the share of the primary sector in total GNP fell significantly while those of the secondary and tertiary sectors increased reflecting the changing structure of the Indian economy.

The regression results showed that overall GNP was significantly related to the overall measure of backward linkages but not to the overall measure of forward linkages implying that economic growth in India is encouraged by the extent and pattern in which Indian industries buy inputs from other industries (i.e. backward linkages) but not by the extent and pattern in which they sell outputs to other industries (i.e. forward linkages). This result concerning forward linkages is surprising and may be due to measurement problems associated with forward linkages.

10.2 LIMITATIONS AND SUGGESTIONS FOR FURTHER RESEARCH.

This study is not free from limitations. The structural change was analysed only in the Input-Output frame. The study does not throw any light on the substitution between labour and capital which revolves about knowledge of production functions. Even within the I-O frame, the role of capital coefficients could not be considered. The study has used the standard, static I-O model for analysing structural changes. The fundamental limitation of the static I-O model is that it represents the economy during a single period of time within which investment in capital goods is treated as a final delivery. In a dynamic model, capital goods produced by one sector in one period are

represented as intermediate inputs that in part replenish and in part expand the productive capacity for subsequent periods of the sectors to which the capital is delivered. The study could not use the dynamic model on account of the nonavailability of capital coefficient matrices of the Indian economy.

Changes in the Input-Output flow coefficients were equated with technological change while in reality technological change is a much broader concept. The impact of structural change on the domestic output of industries and on their imports could also not be studied separately. Such analysis requires further data in the form of import coefficient matrices which are not available in the Indian case. This limitation may have distorted interpretations of results of this study to some extent. For example, the increase in the output of a sector during a certain period may be on account of more of it being imported rather than more of it being produced within the country. Many data adjustments that were made for making the I-O tables comparable add further limitation.

Inspite of the above limitations the present study can boast of presenting a comprehensive analysis of structural change in the production system of the Indian economy. The study provides a good basis to evolve a development strategy for accelerated and balanced growth of the Indian economy. The study yields good material which could be used for further research.

It would be interesting to examine structural changes in the Indian economy using the dynamic I-O framework. This will of course depend on the availability of capital coefficient matrices

of the Indian economy.

The I-O coefficients are the links which transmit changes between industries. The links themselves are related to technical changes and are thus an important central area for the analysis of structural change. The present study gives information about changes in these coefficients and their impact on the development of the economy. This information could be used for concentrating further research on the relatively small group of the most important I-O coefficients.

Further research could be based on studying the endogenous impact of structural change in India by separating the import coefficient matrices from the domestic coefficient matrices, provided the necessary data requirements for this are available for the country.

The analysis of changes in cost shares of primary inputs can be improved upon by separating the primary input vector into components like labour costs, capital costs, indirect taxes and subsidies etc. However, this again requires additional database within the country which so far is not available. Such an analysis, if conducted, can provide more information about structural change in India.

Finally, the results of the study could be used for international comparison of structures of different countries whose economies are closely related by foreign trade with India. This would increase the available information about interdependent structural changes between India and other countries.

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